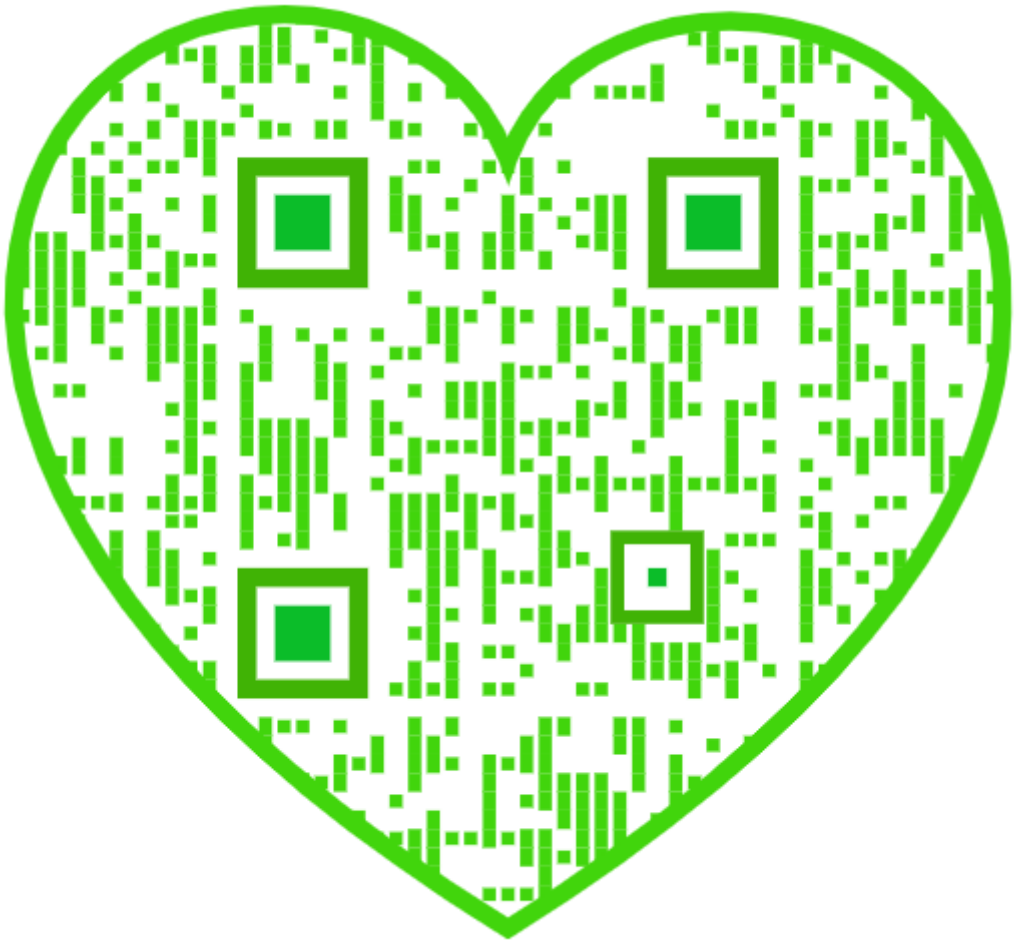

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ON THE

HISTORY AND ART

OF

WARMING AND VENTILATING

ROOMS AND BUILDINGS

BY

OPEN FIRES, HYPOCAUSTS, GERMAN, DUTCH, RUSSIAN, AND SWEDISH STOVES, STEAM, HOT WATER, HEATED AIR, HEAT OF ANIMALS, AND OTHER METHODS;

WITH

NOTICES OF THE PROGRESS

OF

PERSONAL AND FIRESIDE COMFORT,

AND OF THE

MANAGEMENT OF FUEL.

ILLUSTRATED BY TWO HUNDRED AND FORTY FIGURES OF APPARATUS.

BY

WALTER BERNAN,

CIVIL ENGINEER.

VOL. I.

LONDON:

GEORGE BELL, FLEET STREET.

MDCCCXLV.

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LONDON:
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PREFACE.

"Every man's proper mansion-house and home," says Sir Henry Wotton, "is the theater of his hospitality, the seat of self-fruition, the comfortablest part of his own life, the noblest of his son's inheritance, a kind of private princedome; nay, to the possessors thereof, an epitomie of the whole world." The contrivances to improve the focus or hearth whence warmth and comfort are diffused throughout this interesting dominion, form the main subjects of the following pages.

The inventions, of which the scattered notices are here collected, have in most cases been arranged in the order in which they appeared. A short popular account has been given of each; but it will be sufficient, perhaps, to give a practical person all the working hints he would require to enable him to construct a similar apparatus, or to improve it.

The remarks of the inventor, on the advan-

tages and peculiarities of his project, have in a few cases been given at some length. These are frequently instructive as well as amusing, from our observing how often they have been repeated without acknowledgment by succeeding stove-doctors; how often they have been neglected by the public; and how greatly social comfort would have been promoted had they been regarded. The progress of ventilation, for instance, will show that methods have been practised long ago, and have become obsolete and been forgotten, which have recently been revived, and from their manifest advantage to the community are now rising in public estimation: when the individual exertions which have produced this effect are slackened, they will most likely sink again into the same obscurity from which they have been lately withdrawn. "However paradoxical it may appear," says Rumford, "there is nothing more difficult than to prevail on the public to accept the boon of improvement even in matters which come home to every man's business and bosom," like those which follow.

In a community abounding with inventions of the most recondite character, the inestimable value of apparently trifling improvement, is fami-

liar from experience to all. It is not necessary therefore to bespeak indulgence for the apparent simplicity and obviousness of many of these projects, nor for the terms of respect in which the merit of their originators is mentioned. Fuller puts this in a proper light, when he says,—"I should account nothing little without the help whereof greater matters can either not be attained or not long subsist. Although I confess it is easier to add to an art than first to invent it; yet, because there is a perfection of degrees as well as of kinds, eminent improvers of an art may be allowed for the co-inventors thereof being founders of that accession which they add thereto, for which they deserve to be both regarded and rewarded."

Though much has been done by ingenious men in the art of distributing heat for household uses; it must be confessed, that in one or two instances only have they been able to make a permanent impression or bring their contrivances into that general use as to constitute them "machines of society;" while in the economy of fuel for manufacturing purposes invention has already produced marked benefits; yet however great the saving that may ultimately be effected in furnaces still,

from the nature of things, it must ever be of small importance when compared with that which would arise were better methods of heating and ventilating dwelling-houses generally followed;—of the fifteen-and-a-half millions of tons of coals raised yearly from the mines, not more than three-and-a-half-millions are consumed by steam-engines and in manufacturing operations,—leaving eleven or twelve millions of tons of fuel to be mismanaged in kitchens and sitting-rooms throughout the country. The register-plate was described at the close of the fifteenth century by Alberti, the ancient Florentine architect, and by others who wrote afterwards. Were this simple and cheap smoke-valve introduced into every cottage chimney, it would save the heat of five or six millions of tons of coals that is now annually wasted and thrown away.

The numerous engraved figures that will be found interspersed throughout this compilation, are given as diagrams only, to shorten technical explanation; and the Essays are offered as a contribution towards a chapter of what has yet to be written—a history of personal and fireside comfort.

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THE ART OF WARMING AND VENTILATING BUILDINGS.

INTRODUCTORY ESSAY.

The greater frequency and higher standard of bodily and intellectual endowment in some communities than in others are manifest to observation. It is a very ancient opinion that this relative superiority arises from the influence of climate.*

The action of heat on the human body keeps it open to every sensation, while cold invariably weakens its susceptibility of impression. To this agency, says Falconer, may be traced many of the peculiarities that distinguish the various races of mankind.† In hot climates, according to this ingenious theorist, man, possessing feverish sensibility, is liable to all the effects of sudden and reckless impulse on his conduct. He is irritable, wavering, profligate, rapacious, and cruel. His passion, though fierce, on him leaves no permanent impression. So inveterate is his indolence, that he considers absolute repose to be the state of extreme felicity; yet exuberance of idea, fervour of imagination, and fury of action, are characteristic of dwellers under an ardent sun. Recondite discoveries, the most useful and the most ingenious manufactures, and arts

* Vitruvius, lib. vi. c. 1. † On Influence of Climate, p. 34.

of life, have originated among them; and an original, varied, but capricious, elegance is displayed in their productions.

The passions in the inclement zone are sluggish and inert. Man is plodding, rough, austere, ignorant of decorum, and gross in his manners. Prone to violence, war, and plunder, he encounters perils without dismay. Drunkenness spreads over the world in proportion to coldness of climate. Commerce, if suited to the wants, accords not with the genius, of shivering regions; and in art, and in manufactures, their sterility of thought, and coldness of fancy, are exhibited in works that, though good in their kind, are coarse and deficient in taste. With admirable keenness of penetration, the historian of sultry climes is prone, like the poets, to fanciful conjecture, and fervent love of the gorgeous, the dazzling, and the marvellous.* In regions of thick-ribbed ice, the genial current of the soul of the bard is frozen; his strains, without feeling, are addressed to hearts blunted against emotion; and ungifted with subtlety of discrimination to analyze the motives of action, the mere chronicler usurps the place of the historian.†

Aristotle remarked, that extremes of temperature were unfavourable to the powers of the mind; and that perfection in the arts and sciences hardly ever appeared in very high or low latitudes. Galen pointed out the superiority of the inhabitants of the temperate zone in mental energy. The fiery passion of the torrid south is subdued in the genial region by the philosophy of sentiment; oriental luxuriance of idea is pruned by a fastidious taste; and extravagance of imagination tempered by a severe but exquisite judgment. To men, here, are given qualities resulting from an equal balance of opposite temperatures—en-

* Arbuthnot on Effects of Air, p. 148.
† Falconer on Climate, p. 7.

terprise, perseverance, courage without contempt of danger, constancy, probity, candour, generosity, with politeness, and urbanity of manners. The dominion of freedom and justice spreads under the benignant influence of the soft and clement heaven. This is the region most abounding in poets distinguished for loftiness of thought, for richness and beauty of imagery, and for propriety of expression; in philosophers, patient and industrious in observation, and sagacious in deduction; and in orators and historians, who disclose the soul of man while relating his actions. The mechanics excel in useful contrivances, and in delicacy of workmanship. The unrivalled productions of the Greek and Italian artists show they were created under a sky that formed and matured the faculty of perceiving, judging, and embodying beauty and elegance.

After looking at the result of the average temperature of seasons on a community, if we note the effect of the diurnal changes of the atmosphere, they will be seen to exert a powerful influence on the minds of individuals. Persons are often joyful, sullen, sprightly, dejected, hopeful, and despairing, according to the weather; and there are days in which the faculties of memory, imagination, and judgment, are more acute and vigorous than in others.*

The unvarying uniformity, also, that is observed in the temper and genius of the natives of different countries, even after the races have been changed, strengthens the general inference that intellectual difference depends as much on the region as on the race. The ancient Byzantines were not remarkable among their neighbours for mental eminence, and the Turks, who fill their places, inherit the olden peculiarity. The Gauls described by Cæsar, and Parisii by the Emperor Julian, seem almost identical with the French of the present day: and were a race of Laplanders trans-

* Arbuthnot on Air, p. 148.

ported thither, in a generation or two, their transformation into Parisians would be complete.* The Scians were dissolute and voluptuous; for there was a softness in their sky disposing to mirth and indolence. The air of Scio is balmy now, and its medley, often-changed group of inhabitants, is as joyous and sensual as ever. The Scotch and English, acclimated in Ireland, have partaken largely of the national mental characteristics. The rugged temper and savage disposition of the barbarous hordes who overran Europe, were speedily mellowed and humanized by the mild atmosphere of the countries they devastated and conquered.

The effects of climate are more marked on the body even than on the mind. What a miserable and deformed creature is man in polar countries! Stunted, squat, large-headed, fish-featured, short-limbed, and stiff-jointed,—he resembles in many points, the walrus or bear, in whose skins he wraps himself. As he approaches the sunny south, his stature expands, his limbs acquire shape and proportion, and his features are ameliorated. In the genial region he is beheld with that perfect conformation, with that freedom of action, and intellectual expression, in which grace and beauty consist. The Greek of the classic time thought himself the type of the human family—

"In form, how like an angel, in action, how like a God:"

and in the same zone are yet to be found the most beautiful races of mankind.

The cause of these personal varieties will be further apparent by observing the change that takes place on individuals removed from a colder to a warmer climate. Edwards describes the native white men generally of the West Indies, as being a taller race than Europeans.† Long says, the Creoles of Jamaica, in parti-

* Arbuthnot on Air, p. 148.
† History of the British Colonies, vol. ii. p. 10.

cular, are high statured and finely shaped, and the effect of climate is most remarkable in the great freedom and suppleness of their joints. But they, he adds, who leave the island in their infancy, and pass into Britain for their education, where they remain until their growth is fully completed, are not so distinguished.* The Creole women are also perfectly formed, and remarkably graceful. According to Edwards, they have the finest eyes of any women in the world; large, languishing, and expressive; sometimes beaming with animation, sometimes melting with tenderness. Their Celtic and Saxon ancestors' eyes were "sparkling and merry and small." The tall, lank, and otherwise remarkable figures of the gaunt-looking Virginians and Carolinians, are strikingly different from those of the short, plump, round-faced farmers of the midland counties of England, as well as from the Anglo-Creoles scattered over the Caribbean Sea. Yet they all spring from the same stock. Men of uncommon stature, and even gigantic form, are much oftener seen in Ireland, than in our island.† And as physical peculiarities, common in a particular country, are held to be the effect of some local influence, the differences between the Irish, the Scots, and the English, in the growth of their bodies, and even in their features, have all been referred to the "power of climate."

Arbuthnot's enthusiasm carried him much farther. Air, in his opinion, not only fashioned body and mind, but had a great effect in forming language. He thought the serrated close way of speaking among the northern nations, was owing to their reluctance to open their mouths wide in cold air, which made their speech abound in consonants. From a contrary cause, the inhabitants of warmer climates formed a softer

* History of Jamaica, vol. ii. p. 262.

† Prichard. Researches into the Physical Hist. of Mankind, vol. ii. p. 563.

language, and one abounding in vowels.* The Greeks, inhaling air of the happy medium, were celebrated for speaking with the wide opened mouth, and for sweet toned, sonorous elocution.

Instinct teaches animals to seek a warmer sky on the approach of winter, and retire to a cooler region on the coming of summer. And so perhaps would a human being act, were he free to follow his natural impulse; but the slave of passion and society sacrifices to local attachments the greatest blessings of health, and even life itself. Man is, however, unable to bear extremes. No practice can render him proof against the rigour of winter's cold, or enable him to withstand the lassitude produced by extreme heat. If he is seen indigenous with the bear and rein-deer in the arctic circle, and with the elephant and lion under the equator, he owes his power of living in every climate solely to his ingenuity.

The natural heat of the body is about 98° F., and the functions of life maintain it nearly at this warmth in air of every degree.† The mean temperature of the hottest countries does not perhaps exceed 86°; so that in the warmest climate in which man lives, heat must be continually abstracted from his body. As nature perhaps generates a certain quantity of heat in a given time, air a certain number of degrees colder than the body will abstract the animal heat as fast as it is elaborated. Many races inhabiting regions with the mean heat of climate as low as 74°, make no use

* On Air, p. 154.

† In dry air heated to 240°, Dr. Dobson found the heat of his body to be 99·5°. He remained 10 minutes in air at 210°, his heat was 101·5°. A young man of delicate habit was 10 minutes in air at 224° (12° above boiling water), his animal heat was as high as 102°. Tillet and Morantin state that air was respired at 300° and 325°. In Quito, Bonpland and Humboldt found fishes alive in water at 210° that had been emitted by a volcano. Dogs have existed in air a 236°. Some oven-girls in Germany breathed air at 257° for 15 minutes, and at 288° for 10 minutes, without inconvenience; one girl inhaled it at 325° for 5 minutes. Sir Joseph Banks moved about in a room at 211°, and Sir Charles Blagden in one at 260°. Sir E. Parry breathed air 40° under Zero, F.

of clothes during the day: The heat emitted from the body by radiation, conduction, and evaporation, may be about equal to that generated in the same time by the organic action, and they feel a pleasurable sensation in moving about naked.

In the most sultry climates, the air of evening cools many degrees below that of day. Beneath the cloudless sky of night, ice in large quantities is formed in the plain of Bengal, and the person exposed to the nocturnal heaven experiences extreme cold. Clothing was contrived in warm climates to avoid this hurtful sensation; and there are "few inventions that have displayed so much sagacity, and done so much honour to the human understanding." Leaves, the bark of trees, interwoven bulrushes, and the skins of animals, were among the first substances selected to cover the body, without cramping the freedom of its movements. And as men became more ingenious, they clothed themselves in garments of hair, cotton, flax, silk, or wool. But of whatever material they composed *dress*, experience must soon have taught them that it imparted no warmth of itself. It was the mere mechanical means of preserving their own heat, to form a *portable climate* suited to their necessities and constitutions.

During summer in Egypt, one fold of cotton is sometimes found to be an incumbrance; yet, when moving in the evening air, two folds of woollen are necessary to prevent the unpleasant dispersion of bodily heat. Three thicknesses of broad-cloth and flannel, and two of cotton, about balance the demand and supply from the surface of a moderately corpulent citizen, and keep him "comfortable" when the air of Middlesex freezes water. The Greenlander wears a sheepskin shirt with the wool turned inwards, the second is placed with the wool outwards, and he draws over them a couple of woollen waistcoats. His legs are

cased in two folds of sheepskin; and his boots of rein-deer skin, with the hair outwards, are well lined with sheepskin covered with wool. His sheepskin gloves are inserted into double mittens of fur and wool. Over all he throws a bear-skin pelisse, and his outfit is complete when he crowns the whole man with a woollen wadded nightcap adorned with fur. Yet, notwithstanding these precautions, he cannot always preserve himself from frost-bitten extremities.

But the call of nature for repose, the vicissitudes of weather and season, and many employments of life that compel the bulk of mankind to spend a large portion of their lives under cover, create a want that personal warmth alone is inadequate to supply. With the heat copiously emitted from the bodies of animals, was formed perhaps the first *artificial climate*. The convenience and economy of this ancient method keeps it still in use; and notwithstanding the advance of refinement, it adds to the comfort of numbers, even in La Belle France itself. In Normandy, where the cold is severe, and the firing expensive, the lace-makers, to keep themselves warm and save fuel, agree with some farmer who has cows in winter quarters, to be allowed to carry on their operations in the society of the milky mothers. The cows are tethered in a row, on one side of the apartment, and the lace-makers sit cross-legged on the ground on the other side, with their feet buried in straw. The cattle being out a-field by day, the women work all night; and numbers of young men of their own rank resort to these cowhouses, and sit or lie down on the straw beside their sweethearts, and sing, tell stories, and say soft things to cheer them in their labours.*

The Laplander fences against the snow, and warms himself in a different manner. In the centre of a little hut he makes a hearth, and a small hole in the

* St. John. Journal of Residence in Normandy, p. 98.

roof over it, for the admission of light and escape of smoke. He lines the inside with skins, and spreads others over the birch spray on the floor, for his family and himself to sit and sleep on. In the smoky, putrid, torrid emanations from body and lamp, the Lap exists for eight months in the year covered but slightly with clothing. The Greenlander, advancing a step farther, builds his hut of stone or turf, and about eight feet high, with a flat roof. The holes for the windows he fills with the maws of hallibuts instead of glass; the walls are hung with skins, and the door is so low that he creeps on all fours to gain admittance. Here half a dozen families live together, each having its own portion of the hearth, with a trivet and lamp, over which are hung the kettles for cooking. The room is as hot as a bagnio; and the animal exhalations, the effluvia from the burning lamps fed with whale oil, and from many sorts of raw meat, fat, and fish, and other matters kept in and near their cottages, "create such a smell," says Egede, "that it strikes one not accustomed to it to the very heart."*

The bitings of cold that are found more grievous to be borne than a loathsome atmosphere, and the difficulty of procuring fuel, reconcile the Lap and Greenlander to their distasteful habitations. But what can the Scottish peasant urge, who has abundance of firing, and is acquainted besides with the methods of making it form a wholesome climate, that he should be content to breathe an air as nauseous as that which pollutes the Greenland cottage? Nothing, says Laing, can exceed the squalor, dampness, darkness, and total want of accommodation and comfort, of the sod-built hovels that disgrace the face of the earth in Scotland. Within sight of its Parthenon, human dens may be found in which whole families—father, mother, and grown up daughters and sons—

* Account of Greenland, p. 117.

are lodged under one roof, without other division into apartments for the decent separation of the sexes than is made by a wooden bedstead placed in the middle, without other floor than the raw earth. The walls of sods and stones, not lined with wood inside; the roof a mass of damp rotten straw, and decayed vegetable substances, supported by a few sooty rafters; the windows of a single pane or two of glass stuck in a hole in the thatch or in the wall, or perhaps the light comes down the chimney, or through a hole in the wall, closed at night with an old hat or a pair of old breeches. The family provisions of salt meat, herrings, milk, butter, huddled together in the same room, in which all the wet stockings and sweating shirts are fuming and drying, and all the exhalations of the crowded inmates, working, cooking, eating, and sleeping, are poisoning the atmosphere.*

In Ireland these matters are not managed any better. We, who see the poor man's dwelling generally kept clean and comfortable, can form no idea of the miserable abodes of the Irish peasantry. An Englishman in anger might consign his enemy to one of these hovels for an hour or two, but he would hesitate to lodge his horse for a night in the best of them. A hut, described as a fair specimen of a large class, was thirteen feet long, eleven feet wide, and six feet and a half high, and without hearth, chimney, or window; its earth floor was in little hillocks, and had water standing in pools in many of the valleys, through which the ducks and pigs plashed in and out at pleasure. The potato binn was under one of the beds, the other served for table and chairs, and the space beneath for cupboard and larder. This was the home of four persons, a small cow, some poultry and swine.† In another cottage the inmates were not

* Travels in Norway, p. 18, 288.
† On Small Farms and Emigration, p. 13.

worth a chair, and the mother sat on the ground. "Yet the happy countenance of this woman surprised me," said the visiter, "and I feel that if I were to call her poor I should do her an injustice."* The garments that hang on great numbers of these cheerful-faced creatures can intercept but little of their organic heat; for in their dress they appear almost as independent of the arts as the birds of the air or the fishes of the sea.† When near a turf moor, their miserable dwellings, however, are warmed in the winter, almost to suffocation, and are full of smoke; but it is in the still, warm, moist air of a summer's day when they feel most revolting to the senses of a stranger. At that season the indoor atmosphere is indescribable.

Sieber describes Crete to be a delightful country—a paradise of sweet smells. Not only is the air balsamic with the exhalations from an aromatic herbage, but the very smoke from the fire is redolent of the aroma of thyme, sage, cystus, cypress wood, marjoram, and lavender, which form the common fire-wood of the island. From a fragrant atmosphere a-field, and scented fuel crackling on the hearth, we anticipate an artificial climate altogether voluptuous. But perfumed smoke in certain cases offends the eyes and lungs as much as vapour from turf and pit coal; and notwithstanding the difference in the heating materials, an Irish cabin is perhaps as salubrious as a cottage in Crete: when a traveller tried for two days to keep the cold out of the proésto's hut at Gonies, with a fire of odour-emitting wood, "he was *stifled* and *blinded* with the smoke, for the cottage was built in the common fashion of the country, without a chimney."‡

* Binns. Miseries and Beauties of Ireland, p. 71.
† Excursions in the South of Ireland, p. 79.
‡ Pashley. Travels in Crete, vol. i. p. 160.

About the middle of October every house in Seville is in a complete bustle for two or three days. The lower summer apartments are stripped of their furniture, and every chair and table are removed to the opposite side of the court. This change of rooms, together with mats laid over the brick floors thicker and warmer than those used in the warm season, is all the preparation against winter that is made in Spain. A flat and open brass pan, about two feet in diameter, raised a few inches from the ground by a round wooden frame on which those who sit near it may rest their feet, is used to burn a sort of charcoal, made of brushwood, that is called *cisco*. The carbonic vapour is most injurious to health; but such is the effect of habit, that the natives are seldom aware of the inconveniences arising from the stifling fumes of their braziers.*

The personal comfort that the Greenlanders, and others, promote by increasing the thickness and number of their garments in the cold weather, the Italians and the Germans partly obtain by the use of the *scaldina*, or *riken*, a small basket-shaped vessel, made of copper or earthenware, and containing burning charcoal. This utensil they sometimes place before them on the table, sometimes at their feet or on their knees, till warmth has been communicated to all parts of their bodies in detail, whilst the careful housewife hangs at her waist a long bodkin, with which she stirs up, from time to time, the sleeping embers.† "Italian women of all ranks use it, and carry it with them wherever they go, both in the house and abroad, and call it their 'marito;' and it is indeed the 'husband' to which they are most constant."‡

In Persian houses, a large jar, called a *kourcy*, is

* White. Doblado's Letters, p. 170.
† Blunt. Remarks on Italy, p. 233.
‡ Rome in the Nineteenth Century, vol. i. p. 79.

sunk in the earth, generally in the middle of the room, with its mouth on a level with the floor. This is filled with wood, dung, or other combustible; and when it is sufficiently charred, the mouth of the vessel is shut in with a square wooden frame, shaped like a low table, and the whole is then covered with a thick wadded quilt, under which the family, ranged round, place their knees, to allow the hot vapour to insinuate itself into the folds of their clothing; and when cold, they recline with the quilt drawn up to their chins. The immoveable position necessary for receiving the full benefit of the glowing embers is inconvenient; and the effluvia from the fuel is nauseous and deleterious. Headache is always produced; and as many creep wholly under the quilt at night, the incautious sleepers are often found suffocated. The kourcy also serves for an oven, and the pot is boiled on its embers. Barbarous as the method seems, it is found in the noblest mansions of the cities, as well as in cottages, but burning more agreeable fuel; and then the ladies will sit from morning till night under the rich draperies spread over the wooden cover, awakening their slumbering senses from the soporific influence of its vapours by occasional cups of coffee, or the delightful fumes of the kalioum.*

At Amamloo, in the Caucasus, the form of the cottage is like that of a large rabbit-hole, from sixteen to eighteen feet wide, and generally of still greater length. Being dug three or four feet below the surface of the earth, it has a greater height within than is indicated by its exterior. At one end, commonly near the door, a space is always left untouched by the spade sufficient to form a distinct chamber, but no otherwise divided from the sunken part than by the more elevated floor. At one side of this superior quarter, is found the hearth with its chimney, and

* Porter. Travels in Georgia and Persia, p. 274.

opposite to them a small hole in the roof to admit light. The floor is the bare earth beaten very hard, on which coarse carpets are spread for its people to sit and sleep on. The pit is assigned to the pigs, sheep, and horses.* The Tartar cottage is seldom found above the surface; the top is covered with beams of wood, branches of trees, and over these with a coat of earth, which makes it level with the ground. The inmates of the pit are frequently disturbed, when sitting round the fire, by the leg of some unfortunate cow or camel making its appearance down the chimney; and it is not uncommon for lambs to fall through, and spoil whatever may be cooking.† The smoke and light flow through the same aperture. In the cold weather this is often kept closed; and when the atmosphere becomes no longer breathable, a little fresh air is occasionally admitted by raising the stopper. The artificial climate in this, and in the Caucasian cottage, is a hot gaseous olio that produces overcoming sickness and disgust.

In cold countries, a very high degree of heat within doors, relatively to that in the open air, is as much a necessary of life as food or clothing; and fuel is burned without reference to any other object than to produce a high temperature in the apartment. Stoves are used for this purpose in Sweden: warmth and sweet air are, however, seldom found united in the Scandinavian cottage, which is generally "a close and filthy room, crowded with pale, swarthy, wretched-looking children, sprawling upon the floor in the midst of the most powerful stench."‡ Among the Cossacks, fuel is the only article they do not possess in abundance; but the peasant contrives to keep his hut at an insufferable degree of heat, with the reeds

* Porter. Travels in Georgia and Persia, p. 117.
† Armstrong. Travels to the Seat of War, p. 186.
‡ Clarke. Travels in Scandinavia, p. 109.

and grass procured from the adjoining steppe, which he burns in a stove that is generally built within the apartment, and heated from the outside. On the top of it, removed a few feet from the ceiling of the room, the women thickly clothed in sheepskins, and the children swaddled, pass a great part of the day, and all the family sleep at night.* Throughout Russia, the use of stoves is general, and firing is managed with great economy; but neither lord nor peasant being aware of the necessity of pure air to a healthy and cheerful existence, the artificial climate produced has no attraction for the lover of a sweet and balmy atmosphere. "On entering a Russian cottage, a stranger is almost suffocated with the horrible effluvia with which it is filled, and the effect on his lungs is such as to deprive him of the power of speech, and that of standing upright."†

The Polish serf adopts the same contrivance; at one corner of the cottage are placed four upright posts, round which are entwined some twigs covered with mud and clay to form a square area, in which is built an oven, or furnace, of the same materials. This, when hard and dry, serves for kitchen, chimney, stove, and bed. On the top and at the sides of the oven, both sexes of all ages sleep together like pigs, on straw or furs, without undressing themselves.‡

This method of procuring a warm bed is followed in places widely apart,—at Archangel, at Moscow, at Nankin, and at Grand Cairo. In the neighbourhood of the latter place, the cottages, which are usually built of unburnt brick cemented with mud, have two rooms with small grated openings, placed high in the walls. An oven (*foorn*), made of brick and mud, generally occupies the whole side of one of the chambers. It is arched within, and flat on

* Macmichael. Journey to Constantinople, p. 60.
† Loudon. Architectural Magazine, vol. ii. p. 113.
‡ Neale. Travels in Poland, p. 119.

the top, and resembles a wide bench about breast-high. Having previously lighted a fire within it, the family, who have seldom any night covering, during the winter enjoy repose on the top of the oven.* In China, the houses of the trading classes generally consist of two rooms. The larger serves for the reception of company, for a temple, and sleeping room. At one end of the apartment are massive benches or places, built hollow with bricks, in the form of a bed, which are larger or smaller according to the number of the family. On one side of the bench is a small stove wherein they put charcoal or fossil coal, whose flame and heat are dispersed to all parts, by pipes, which end in a funnel that carries the smoke above the roof. In the houses of persons of distinction, these pipes come through the wall, and the fire is lighted from the outside; by this means the bed is heated, and even the whole house. Some who dislike lying immediately on the hot bricks, or on the felt mat that is often spread on them for softness, suspend from the ceiling over the heated bench a kind of hammock made of a coarse cloth, and in that enjoy warmth and repose. In the morning every thing of this kind is cleared away, and the bed-places are covered with carpets or mats, on which they sit. As they have no fire-places, nothing can be more convenient. The whole family work upon these hot seats without feeling the least cold, and without being obliged to wear garments lined with fur. At the opening of the stove the meaner sort of Chinese dress their victuals; and as they drink every thing hot, there they warm their wine, and prepare their tea. The beds in the inns are much larger, in order to accommodate several travellers at one time.†

These examples will be sufficient to show the need

* Lane. Manners of the Modern Egyptians, vol. i. p. 24.

† Du Halde. Account of China, vol. ii. p. 150.—Abel. Narrative of a Journey in China, p. 175.—Staunton, vol. ii. p. 338.

of artificial heat for personal comfort, under the most opposite conditions of climate, as well as the sacrifices of enjoyment and health that are every where made to obtain it. When, therefore, the Laplanders, and other inhabitants of arctic regions, are observed passing three fourths of their time in a hot, contaminated, factitious atmosphere, and Swedes, Poles, Russians, and the natives of more southerly countries spending half their lives in closed rooms, kept at the temperature of summer, it is clear that *artificial heat* must have a great effect in producing the general result that is usually ascribed solely to the operation of natural climate. Accordingly, it is found, that as firing is scarce, or abounds in a particular territory, or as it is cheap, or high-priced, and more or less skilfully managed, the natives exhibit mental and bodily peculiarities as if they were inhabitants of opposite geographical climates. Strongly marked differences are seen within very narrow limits; even in communities of the same race living in the same temperate climate, and adjacent to each other.

Anciently, Buckinghamshire was overgrown with wood until it was cut down to prevent its harbouring the robbers, with which the district had become infested. But the remote effect of denuding the land has been to dwarf its people, if not somewhat to dull their wit. In the county of Lancaster, says Sir Gilbert Blane, the great abundance and cheapness of fuel is extremely favourable to life, health, and comfort; and he thinks it is owing to this advantage that the inhabitants of this district, particularly the females, have become noted for their well-formed persons and comely countenances, —forming a contrast with those of Buckinghamshire, where fuel was exceedingly scanty and high-priced before the extension of inland navigation, so that the labouring classes suffered extreme hardship from this privation, and are of a stature so inferior, that militia-

men, by act of parliament, are admissible at a lower standard than in the rest of England.* To the ancient profusion of peat, coal, and wood, throughout their generally bleak and exposed country, has been attributed the acuteness and activity that proverbially distinguish the personable stalworth natives of Yorkshire.† Their average height exceeds that of Devon and Cornwall men, who live in a much milder climate. The Irish having very impoliticly destroyed their woods, says King, and stone-coal being found only in a few places, they could hardly live without some bogs. These, however, covered a tenth part of the country in the doctor's time.‡ That the national fuel is still plentiful, and near every man's door, is seen in the prevalence of masculine forms, and an oriental cast of mind, among his countrymen. The Russ-Slavon is of a middle size, clumsy, but vigorous; the Pole-Slavon, from the influence of a superior climate, and a less stinted supply of firing, is taller and more graceful.§ The Norwegians are a well-lodged people. The poorest dwelling has a wooden floor, glass windows, and an iron *kakle* or stove.‖ Though living in a more inclement region, yet, from their greater dexterity in the production of indoor climate, they are a better grown race than the north-western Scottish Highlanders, among whom fuel formerly was procured with great difficulty, and consumed as now in the rudest and

* Medical Dissertations, p. 74.

† When Henry VIII., in his progress to York, was some few miles north of Doncaster, Tonstal, bishop of Durham, pointed out to the king a valley that contained, within ten miles of Hasselwood, the seat of the Vavasours, 165 manor houses of lords, knights, and gentlemen of the best quality; 175 *woods*, some of them containing 500 acres; 32 parks, and 2 chases of deer; 120 rivers and brooks, well stored with fish; 76 water-mills for grinding corn; and 25 *coal-mines*, which yielded abundance of fuel for the whole country. Fuller. Worthies, vol. ii. p. 489. 1811. A thick crust of turf covered many thousand acres of Hatfield Chase, from which, in former times, Yorkshire was supplied with much of its fuel.—Hunter. South Yorkshire, vol. i. p. 154.

‡ Phil. Trans. 1685. § Pinkerton. Geography, vol. i. p. 219.

‖ Laing. Travels in Norway, p. 31.

most unthrifty manner. In France, enjoying a warmer sun, but where the inhabitants endure much privation from a scarcity of firing, the average height of a man, according to M. Quetelet, does not exceed 5 feet 4 inches. In the Netherlands fuel is more plentiful and easier procured, and there the average height rises to 5 feet $6\frac{1}{8}$ inches, and in England, that has an abundance of coal, within the reach of its population, the average height is upwards of 5 feet 9 inches. In spite of the obstacles arising from the rigour of their seasons and uncleanly habits, the Swedish peasants attain a healthy maturity, and appear characterized by sturdiness of form, and the most athletic stature; many of them seem to belong to a race of giants with nerves of iron.* Their inexhaustible forests make fuel abundant; and they use their store with skilful economy.

The effect of artificial heat on the great scale, in ameliorating climate and improving the general health of towns, is also most remarkable. It almost reverses the order of nature, and makes a town most healthy when its atmosphere appears to be the most insalubrious. Notwithstanding the palpable contamination of the air from the immense volumes of deleterious gas that issue from its myriads of chimneys, and the numberless other sources of pollution to which its dense population are exposed, the greater healthfulness of London, when compared with the country, in winter, is a fact that may almost be considered as established by experiment; and which has been accounted for from the higher degree of warmth that is maintained in every house by more numerous fires, from the radiation of heat from their walls into the street, and from the better ventilation which this agency produces. Yet, with this advantage, who can deny

* Clarke. Travels in Scandinavia, p. 109.

the frightful waste of health and life produced in a large portion of its population, through living in ill-ventilated apartments, often fatally aggravated by noxious exhalations from putrid decomposing matter in drains and in streets. But in truth, the same causes are producing the same suffering and mortality in town and country every where.

Leaving Falconer and his disciples in possession of their dogma, that governments may stamp the manners, but it is the air they breathe which moulds the form, temper, and genius of a people, if we may go so far with the ingenious enthusiasts as to admit, that warmth exerts a considerable influence on our physical, if not also on our mental condition, the *formation* and *regulation* of *artificial climate* will then assume the character of an art for developing and expanding the mind and the body, for preserving health, and prolonging life; and the skilful practice of the art, as a means of saving fuel, will become essential not to the well-being only, but to the existence of many communities.

It is obvious, for example, that if fuel in Buckinghamshire had been used with perfect skill, no other way remained of removing the general starvation than to procure, if they could, the aliment of fire in greater quantity; but if the ancient mode of burning coal or wood were the same as that practised *now*, then it is certain that four fifths of its effect was thrown away. By a more perfect mode of using firing, therefore, its effect might have been made five times greater, which would have been the same thing as making wood or coal five times more abundant. By skilful management of their scanty supply, the people of Bucks would have been as tall, and have enjoyed equally robust health, equal chance of long life, and equal comfort, with the inhabitants of Lancashire; and their maidens would have been as distinguished for their shape, symmetry, and pleasing faces, as the northern

beauties, whose personal attractions were developed and preserved by burning five times more coal. Nay, if the Lancastrian women themselves, amidst their wealth of fuel, had studied its economical application, and used a fifth part only of what they did, then, instead of encountering the fierce extremes of heat and cold every time they approached their blazing fires, they would have moved in an equably warmed and genial climate, with exemption from diseases, engendered by noxious currents of cold air, that destroy some of the fairest works of creation in the county palatine, and throughout our island. "O, happy Laplander," exclaims Linnæus, "you live contented, in your sequestered corner, to a cheerful, vigorous, and long extended old age, unacquainted with the numerous disorders which constantly infest the rest of Europe. You live in woods like the fowls of heaven, and neither sow nor reap, and yet the beneficent Deity hath provided for you most bountifully. Your drink is the crystal stream; your food, in spring fresh-taken fish, in summer the milk of the rein-deer, in autumn and winter the ptarmigan and the rein-deer's flesh, newly killed; for you use no salt, neither do you make any bread, and are a stranger to the poisons that lurk under honied cates." How miserably is this fine picture of polar happiness destroyed by the disregard or ignorance of the art of ventilation! *Lappi, lippi sunt,* quaintly observes their philosophical admirer. The nauseous smoky cottage afflicts the whole nation with the only disease to which it is subject—blear eyes. In the Greenlander's anxiety to save all the heat which the extravagant man of Lancashire throws away, he loses sight of the baneful action of a putrid atmosphere on his constitution. Yet, with a little ingenuity, he might ventilate his unsavoury apartment, and breathe an air as pure as that blowing over his ice-fields, and as bland and balmy as if it

were wafted from the bay of Naples; and though cast by fate into the snowy wilderness, his body and mind, feeling the heavenly influence, might assimilate to the godlike standards of his species in the incense-breathing south. By a proper application of the non-conducting powers of a few substances, an apartment might be constructed for the Norman women, who chose to club their own heat, in which, by burning the same weight of tallow during day that is consumed in candles during night, the presence of the milky mothers might be dispensed with, the lace-making operations be carried on in sunlight, and in a more pleasant atmosphere than that of the cowhouse. Even the Scottish, Irish, Polish, Russian, Caucasian, Grecian, Spanish, and Persian dwellings, might have their atmosphere sweetened, their dangerous inequalities of temperature regulated, and the benign influence of natural climate be aided and infinitely increased withal. It should never be overlooked that by breathing pent-up, effete air, all the advantages of an abundance of fuel, and every blessing of a genial sky, are utterly thrown away; and though the habitation were on the hill top, fanned by the sweetest breezes of heaven, it would become the focus of contagious and loathsome disease, and of death in its most appalling aspect. On the other hand, even in the confined quarters of a crowded city, rife in malaria, and where pestilence is striking whole families and classes, ventilation and warmth, with cleanliness, their usual attendant, like the sprinklings on the lintels and doorposts of the Hebrew dwellings, stand as a sign for the Destroying Angel as he passes over to stay his hand, for in the warm, fresh-aired chamber none may be smitten.

ESSAY II.

THE effects of heat are so obvious to our senses, and its agency is so essential in the arts which supply our necessities and minister to our pleasures, that it is difficult to imagine how an individual could exist, and be unacquainted with fire, and independent of its manifold uses.

Few circumstances, however, are less doubtful than the ignorance of this element among the primitive races. The early history of most nations refers to a time when among them fire was unknown.* A Phœnician tradition attributed its discovery to a hunter observing a conflagration that had been excited in a forest by the attrition of some trees during a storm. In the winter season, according to an ancient account, Vulcan the king coming to a tree on the mountains that had been fired by a thunderbolt, was cheered by its heat; and adding more wood to preserve it, he invited his companions to share in his pleasure and thereupon claimed to be the inventor of flame.†

* Instances of the same ignorance occur in very recent times. When Magellan visited the Marian Islands in 1521, the natives considered themselves to be the only people in the world. They were without every thing which we consider to be necessaries, and in total ignorance of fire. Several of their huts being consumed, they at first considered the flame to be a kind of animal that attached itself to the wood and fed upon it. Some who approached too near, being scorched, communicated their terror to the rest, who durst only look upon it at a distance. They were afraid, they said, that the terrible animal would bite them, or wound them with its violent breathing. They speedily learned to use fire with as much address as Europeans.—Gobien. Hist. des Isles Marianes, liv. ii. p. 45.

† Diodorus Sic. b. i.

Another legend varies the circumstances. The primeval savages sheltered among the trees fled at the "outburst of indefatigable flame." On returning to the spot, and feeling the blessed influence of heat, they remained for the first time together; and as the intercourse continued under the bond of the common enjoyment, the incoherent sounds by which they expressed their emotions were by degrees roughly cast into the elements of speech; thus the discovery of fire gave rise to the first social meeting of mankind, to the formation of language, to their ultimate union, and to all the wonders of subsequent civilization.* The poetic fiction of Prometheus stealing fire from heaven in a hollow reed, the Cretans, perhaps, reduced to a matter of fact by asserting the son of Japetus to have been the first merely who struck fire from flint,†—a claim that was not, however, acknowledged by the Argives. That people kept burning, in the temple of Apollo Lycius, the fire of Phoroneus, the son of Inachus, as being the first, they said, who called men into civil society, and began by teaching them an easy and commodious way of preserving fire.‡ While, according to the Chinese, it was Souigine, one of their first kings, who, following the inspiration of Heaven, first taught his countrymen the art of producing flame by rubbing two pieces of dried wood strongly against each other.§ Then,

* Vitruvius, b. ii. c. 1.

† The ferula of the ancients, says Tournefort, grows abundantly in the island of Skinosa, where it is called *Nartheca*. It bears a stalk about five feet high and three inches thick, has a knot at every ten inches, and is covered with a hard thick bark. The hollow of the stalk is full of a white marrow, that, when well dried, takes fire like a match, and consumes very slowly, without damaging the bark. On this account, the natives use the plant to carry a light from one place to another. The custom is of great antiquity, and may help to explain Hesiod's fable, which, doubtless, proceeded from Prometheus being the inventor of the flint and steel, and using the pith of the ferula for tinder, and teaching men how to preserve fire in the stalks of it.—Voyage du Levant, p. 245.

‡ Pausanias, l. ii. c. 19.

§ Martini. Hist. de la Chine, t. i. p. 20. Origine de Lois, vol. iii. p. 305.

says Tienchi, from being slaves of earth, like the barbarians, the children of the celestial empire became the eyes of the world, for they alone could produce fire, and convey it to places where it was wanted. But for this contrivance, he truly adds, a great portion of the earth must have remained a desert, and its herds of talking animals must have for ever wandered over its surface in comparatively helpless barbarism. Neither will our admiration of the discovery be diminished, on finding that for many thousand years no improvement was made on the simple method by which the inventors first warmed themselves and their neighbours. A fire of dried wood or grass made in the open air, or in the centre of the cave or tent, was the sole provision against cold among the nomadic races; and the same rude method was followed when men had gathered into societies and inhabited populous cities.

The earliest examples are drawn from the buildings of the Egyptians. Their houses were generally small, connected together, and formed the continuous sides of streets: they seldom exceeded two stories in height, and had the reception rooms and dormitories placed in the upper floor. All parts within and without were stuccoed; the walls of the rooms were painted, and the floors paved. The doors, formed with one or two valves, turning on metal pivots, opened inwards, and were fastened by bolts and locks. Window openings were fitted with lattices and shutters, that could be secured like the doors; they were made very small, on the principle that where little light is admitted, little heat penetrates.* Yet though familiar

* Wilkinson. Manners of the Ancient Egyptians, vol. ii. p. 124. To the want of glazed windows is owing much of the discomfort experienced in Egypt in the cold chilling air of winter, and lattices are no protection from the inconveniences of winds at any season. "In the hot wind *merisj*, dust enters rooms that are the closest shut, and into the very beds and 'scrutoires. The natives say that it will

with the manufacture, and many of the uses of glass in the time of the Pharaohs, the Egyptians overlooked its application as a transparent weather screen, and thus were without the enjoyment of rooms with a cheerful light and a proper ventilation in all seasons. Their furniture consisted of chairs and ottomans with stuffed seats, carpets, floor mats, raised bedsteads, and couches with mattresses; or the Egyptian might repose on the floor on skins and cushions, with bedding perhaps composed of the same materials as his garments—linen, cotton, or woollen. From the manner in which their houses were constructed, the use of doors and shutters, and the convenience of the furniture, it is clear this people, at a very early period, had made great advances in the arts of life, and were in possession of the elements of a comfortable indoor climate in the genial seasons.

But in this region there are great vicissitudes even of diurnal temperature. Fires are often pleasant in the evenings of June; and if they may be sometimes omitted in the middle of the day for an hour or two between November and March, the nights and mornings during that season are so cold that artificial heat becomes necessary to comfort. This was obtained by the primitive means of a fire on a hearth,† or by

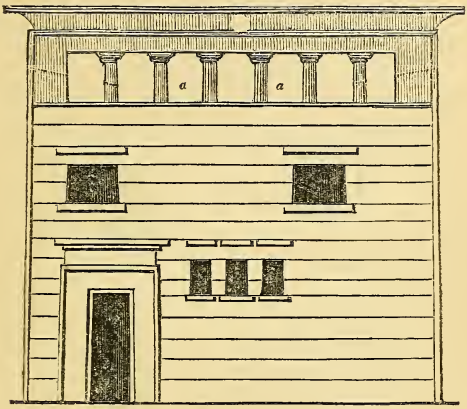
enter into an entire egg through the shell. It feels like an oven, and to avoid it they retire into their lower rooms and vaults, and shut themselves up close."—Pococke. Description of the East, vol. i. p. 195.

The use of glazed openings is on the increase in Grand Cairo. In the better houses the windows of lattice-work are now generally furnished with frames of glass in the inside, which in the winter are kept wholly closed. They are sometimes placed close together, and in the houses of the wealthy the openings in several of the upper rooms are fitted with stained glass, representing gay and gaudy subjects, bunches of flowers, peacocks, and fanciful designs. These windows, called *ckumáreéyehs*, are mostly from a foot and a half to two feet and a half high, and from a foot to two feet wide. The glass is in small pieces, set in veins of plaster, and enclosed in a frame of wood.—Lane. Modern Egypt, vol. i. pp. 9, 19, 21.

† Which was generally formed with dried vegetable matter for fuel, as in the present day;—the country being destitute of wood for burning, its furnaces even were supplied with straw and stubble.—Exod. v. 7.

placing a pan of live charcoal in the apartment; either method so strangely opposed in its rudeness to the elegance and ingenuity of the other domestic arrangements, that the great discomfort it must have occasioned to a race scrupulously nice and cleanly in person and dwelling, was not much lessened by their practice of burning odorous substances, and strewing their couches and floors with flowers. Their houses being designed more with a view to increase

FIG. I.



the enjoyments of summer, than to mitigate the privations of winter, subterranean chambers, grottoes, and galleries were formed for retirement from the heat; and with the intention also of promoting ventilation, the top of the house was often formed into a terrace, *a*, covered with a roof supported by columns, that by excluding the sun caused a refreshing stream of air to pass through them. In the warm weather the citizen slept on the terrace at night, covered with

a net to protect him from the gnats; or he trusted to a current of wind flowing over the elevated space for preventing the visits of these troublesome insects.

Instead of this pavilion, the upper chambers and passages were frequently covered with what is now called a *mulquf*, or wind conductor, formed on the roof. Its sides, *a*, *a*, were perpendicular and enclosed; and the ends, *c*, *c*, were open, and placed towards the

FIG. II.

prevailing winds. The roof, *e*, *e*, sloped from each open end to the centre, where a partition divided the *mulquf*. When the breeze set in the direction of either opening, the wind was deflected downward by the inclined roof, and a constant stream of air was conducted into the apartments beneath. It does not appear to differ from those still erected on the house-tops in Egypt, except in being double, and in the

openings facing opposite directions.* In the interior of their houses they also endeavoured to promote a partial ventilation, by placing small openings near the ceiling, opposite each other.

The art of producing fire was imperfect until a method was found out of concentrating its energy; the first bellows was probably a mere reed or pipe, that was afterwards improved by a metal tip to resist the heat. On the authority of Strabo, who quotes from an ancient historian, the invention of the bellows with a bag of air, was assigned to Anacharsis, though in use among the Egyptians long before the time of the Scythian philosopher. Its form and the method of using it, are represented in a painting executed about the time of Thothmes, who was cotemporary with Moses. The machine consisted of two leathern bags fitted into a frame attached to a long pipe, which conducted the wind to the fire. A string attached to each bag was held by the operator in his hand, as he stood with a bag under each foot. When, by throwing his weight on one foot, he had compressed one bag, and expelled the air, he transferred his pressure to the other foot, and pulling the string attached to the flattened bag, he raised it, and permitted it to be again distended with air. After his weight had pressed down and exhausted

* The modern *mulqufs* are generally directed towards the prevailing north or north-west winds, and are usually "formed of strong framework, to which planks of wood are nailed. When required to be of a cheaper material, the place of planks is supplied by reeds or mats covered with stucco, protected and supported by wooden rafters."—Wilkinson. Ancient Egypt. vol. ii. p. 121.

The tardiness to adopt improvement is well exemplified in the *mulquf* not being introduced into the adjacent countries, where its use would be even more beneficial than in Egypt. "Although the cool breeze," says Burckhardt, "comes only from the north, yet the Arabians do not seem to take as much advantage of it as the Egyptians, whose principal rooms are generally contrived so as to open towards the north. The large ventilators (*mulqufs*) constructed on the terraces of the houses in Egypt, and which diffuse a current of air through all the lower apartments, are unknown in Hedjaz."—Travels in Arabia, vol. i. p. 18.

the second bag, he then again threw his weight on the first bag, and drawing the string of the second flattened skin upwards, he allowed the air to enter it also. And thus, pressing on and drawing up each skin alternately, he forced a continuous blast of air through the pipe into the fire. One instance was observed, of the wind bags being raised up as if full of air after the man had left the bellows, which would imply, as correctly suggested by the truly ingenious antiquary, a "knowledge of the valve" among the Egyptians.*

The use of wood, as a light-giving material, seems early to have been superseded by that of oil in the lamp. Among the Egyptians no festival of any importance was unaccompanied with illuminations. And during the sacrifice solemnized by night at Saïs, all Egypt was illuminated. On that occasion, the lamps

* The ordinary hand-bellows now used in Egypt for fires, are a sort of bag made of the skin of a kid, with an opening at one end like a common carpet bag. The skin is sewed upon two pieces of wood, and these being pulled apart and closed again, the bag is pressed down, and the air is thus forced through the pipe at the other end. Perhaps this is the ancient form. Bellows with sides of wood, like those of the present day, are supposed by some to have been known to the Greeks, though Virgil's description is calculated rather to convey the idea of their being of ox leather without wooden sides.—Wilkinson. Ancient Egypt. vol. iii. p. 340.

In the island of Paros, Emerson saw some Hydriot sailors who were repairing an anchor, use bellows that consisted of "two sheep skins, united by an iron pipe introduced into the fire, which were alternately dilated with air, and compressed by an Arab slave, who knelt above them. The construction must, at least, be very primitive, since they contained no wood in their composition. Nor does any seem, from the lines of Virgil, Plautus, or others, to have been used by the ancients."—Letters from the Ægean, vol. ii. p. 180.

Similar bellows are employed at Morzouk, in Fezzan. "Almost every man there is his own blacksmith. A small mud or clay wall is built to the height of a foot or eighteen inches; a hole is there made even with the ground, and an iron pipe introduced. To this are attached two skins, which open at the upper end by means of two sticks, having a small leathern handle on each. The thumb is pressed through one of these, and the fingers through the other, so that the hand easily opens and shuts the skin. The mouth being closed, the skin is pressed down, and throws a strong blast through the pipe; it is again opened and lifted up, when it is once more ready. Thus alternately with each hand the current of air is kept up to the fire which lies over the pipe."—Lyons. Travels in Northern Africa, p. 48.

suspended in the open air before the houses, to burn all night, were filled with olive oil and salt, and had the wick floating on the top. No representation of lamp, or torch, has been discovered in the paintings or sculptures on the most ancient Egyptian buildings, but, from the public use of them, it is probable that they were, from remote times, the usual sources of light in their apartments.*

The Phœnician communities adopted some comforts seen among their neighbours. The king of Bashan slept on an iron bedstead;† and Eglon had rooms adapted to different seasons of the year. Ehud found the king of Moab sitting in his summer parlour, or "chamber of cooling," that he had for himself alone, and which seems to have been situated on the ground floor, and to have had doors that were moved on pivots, and secured by lock and key. The king, being wont "to cover his feet" in his chamber, in all likelihood had a "convenience" attached to it, that has been thought to be exclusively a modern accommodation.‡

The long sojourn of the Hebrews in the desert, and the extinction of the generation that had been brought up in Egypt, must have "made them indifferent to many comforts, and diminished their skill in the arts that promote them." They dwelt in tents

* An ancient sitting room at Thebes was, perhaps, as cheerless in the evening as one in Grand Cairo, where "By night the interiors present a more dull appearance than in the day. The light of one or two candles, placed on the floor, or on a stool, and sometimes surrounded by a large glass shade, or enclosed in a glass lantern, on account of the windows being merely of lattice work, is generally thought sufficient for a large and lofty saloon. In the winter the saloon is quite as sombre, for as there is no fireplace, it is warmed by a brazier, or chafing-dish (called *muncud*) made of tinned copper, full of burning charcoal, placed on the floor, into which perfume is occasionally thrown. The Egyptians take great delight in perfumes, and often fumigate their apartments, most commonly with frankincense, benzoin or cascarilla bark, and aloes wood; ambergris is rarely used, on account of its costliness. The wood is moistened before being placed on the charcoal."—Lane. Manners of Modern Egyptians, vol. i. p. 21, 171, 188, 257.

† Deut. iii. 2. ‡ Judges, iii. 20.

and slept on skins in the wilderness, and of necessity made their fires on the ground, as the races do who now wander in the same countries.

After their establishment in Canaan, their houses, it has been inferred, resembled those of the Egyptians, "wide, thorough aired, with windows, and large chambers ceiled with cedar, and painted with vermilion;"* and judging from the terms they had to mark the position, size, and manner of closing the apertures, they must have paid great attention to domestic accommodation. Seven different words that, in the Old Testament, mean "openings," are rendered in the translation by the term "window."† One variety of aperture (the *arubbah*) was very small, and formed for looking abroad in a concealed manner. The same word used to describe this peeping-hole, is also applied to a pigeon-hole, and to an outlet for smoke.‡ Moveable lattices are mentioned in the time of the Judges;§ but before this period, openings were filled with a translucent substance,‖ such as polished oyster-shells, that are still used for this pur-

* Jerem. xxii. 14.

No carpets are mentioned in the court of Solomon, nor are costly furs noticed as being used by the Hebrews at any time, but cool and airy robes of purple and fine linen. The use of expensive carpets is now universal in Syria, and furs also, among those who can afford them. About Aleppo, the vests worn by well-dressed people in the spring and autumn, are lined with short-haired furs. The winter robe is lined with long-haired fur; many sleep in winter in these furs.—Russel. Natural History of Aleppo, vol. i. p. 126.

† *Ashnab*, properiy a lattice to ventilate and cool inner apartments. *Shekuph*, an aperture in the wall, with a shutter to close it occasionally. It differs from the *hallon*, or roof window, which always stood open to admit light. *Hallon*, from *halal*, to shine briskly, to irradiate, probably some translucid substance, was used to introduce light through the apartment. *Arubbah*, from *arab*, to lie in wait, probably such openings as those in ancient castles through which arrows were shot. *Isohar* seems to mean something pellucid or transparent, placed in the roof or top of the house to admit the light of the meridian sun. *Sheme shot*, from the sun, because such windows were the medium through which the solar light was transmitted to the house. *Kaveen*, from *kava*, to burn or scorch, because placed in that part of the house on which the afternoon sun shone.—Harmer. Obs. vol. i. p. 347.

‡ Hos. xiii. 3. § Chap. v. 28. ‖ Gen. viii. 6.

pose in the East, or glass, which the Hebrews must have seen applied to many purposes in Egypt. The winter in Palestine being cold and long, and wood abundant, particular apartments were appropriated to the season when fires were wanted, to avoid the nuisance of smoke pervading the house, and soiling its furniture and ornaments. About the latter end of November,* King Jehoiakim was sitting in his "winter house," when he threw the roll of Baruch "into the fire that was burning on the *hearth* before him."† And the prophet Amos alluded to the same custom, when he declared that the "winter house, with the summer house," would be destroyed.‡ The manner in which the fire was made at which the king sat, has been the subject of much discussion. The Hebrew word *ha-ach*, that has been translated "hearth" in the preceding passage, is not the common term for that part of a fireplace, but one that occurs no where else in the Bible. Chardin and Parkhurst suppose it to mean a brazier: while Russel thinks, from the method of heating now practised in these countries, that the fire was on a hearth, which he erroneously supposes had a chimney.§ And it has been suggested that the singular word *ha-ach*, might be rendered "andiron," as this implement, or something serving the same purpose, must always have been necessary

* In the calendar of the Syro-Macedonians, the name of the 7th day of the month, answering to our February, is called "the first putting out of the fire-brand." The 14th day is assigned for its second extinction; the third falls on the 25th of the same month, and is reckoned the end of winter. At the present time fires begin about the end of November, which are left off about the end of February.—Harmer. Obs. vol. i. p. 123.

† 2 Kings, ix. 30. ‡ Chap. ii. 15.

§ In Aleppo, "persons of quality have small winter chambers, which have a chimney, and a hearth raised about a foot from the floor; and they even place their charcoal pans there to avoid the deleterious effect of their fumes in a close place. Their kitchens have large chimneys, and also their public ovens and bagnios, in which great quantities of charcoal and wood, and other sorts of fuel, are consumed;" but he adds, "There are no fire places in their large apartments."—Russel. MS. note in Harmer's Obs. vol. i. p. 496.

when burning wood fuel. From the hearths and braziers in these brumal apartments, the smoke was emitted at a hole in the roof, or by the *arubbah;* for, notwithstanding what some Rabbis have written about the Jews being so scrupulous to preserve the purity of the Holy City, that they would not permit the erection of a chimney in Jerusalem, they were, perhaps, as ignorant as the Egyptians of that contrivance. The great improvement that chimneys would have made on Mount Sion itself, is graphically described by Baruch, when he notices "the faces that were blacked by the smoke that cometh out of the temple."*

The method of using fuel among the Greeks was the same as among the Hebrews, but perhaps without their care for ventilation. Homer describes his princes undressing themselves in the palace, to kill with their own hands the sheep, oxen, and swine they were to eat at dinner; roasting the entrails, and during the entertainment handing them to each other as delicacies. The repast being finished, he shows them sitting for their pleasure on the piled skins of the animals they had slain and devoured, and playing at games of chance, and one of them taking a pastern bone out of a basket in which it was lying, and throwing it at the head of a beggar, but on missing its aim, making a grease spot where it fell on the opposite wall. From this picture of the grossness of ancient manners, it may be concluded that when the poet says, Penelope's maids threw the glowing embers out of the braziers upon the floor, and heaped fresh wood upon them, he did not mean to depict his immortal barbarians burning odoriferous fuel on purpose to sweeten what must have been a vitiated atmosphere.† The fire that was quickly to blaze on the hearth, had to diffuse the comforts of light as well as warmth; and the fragrant logs were known

* Chap. v. 2.

† Odyss. xix. l. 2.

to abound with the resinous material of illumination. In the heroic age they had oil and tallow in abundance, but were ignorant of the method of burning them in lamps; and the only use they appear to have made of wax, was to put it in the ear to shut out sound.* Burning fuel was carried into the apartment where light was required, and sometimes placed on altars for the same purpose; and long thin pieces of lighted wood were carried in the hand when they moved from one place to another in the night.†

In succeeding times the Greeks put cushions on their seats, covered their floors with carpets, had superb hangings for windows and door openings, hung their walls with tapestry, lined them with rare woods, and adorned them with painting and gilding. They lighted their apartments with lamps, and heated them by pans of charcoal, or by fires on a hearth, and the vapour was dissipated at the door and window.‡

* Odyss. lib. 12. l. 173. † Odyss. lib. 18. l. 18. 309.

‡ Beckmann and others have collected a number of passages from ancient authors and opinions on this point; we will here give a synopsis of them.

Homer makes Ulysses, when in the grotto of Calypso, wish that he saw the *smoke* ascending from Ithaca. Is this wish intelligible, Montfaucon asks, unless the houses of Ithaca had chimneys? Smoke may be seen to rise in this manner from doors and windows. Homer describes the arms of Ulysses as tarnished with smoke; and Hesiod, about the same time, says that wood was hardened by suspending it in the smoke of the cottages. Herodotus, in describing the Tauri, says that one of the customs of their warriors was to cut off the head of their prisoner, and carry it to their houses, and "fix it on a stake which is generally placed above the *chimney.*"—Lib. iv. c. 103. Does this word represent what is described by a chimney now? On another occasion he relates, that when the sons of Temenus were commanded by the King of Lebea to depart from his country, they demanded what was due to them. "I give you," said the King, "this *sun,* (the *light* of which came down the *chimney,*) as a proper wages for you." On which one of the brothers exclaimed, "We accept, O King! what you offer us;" and then making a *circular* mark with his sword on the ground, on which the sun shone, and having three times received the light on his breast, he departed.—Lib. viii. c. 137. Some opening for the smoke besides the door is here apparent, and the circle traced on the floor may indicate its shape; but no form of what we call a chimney would admit the light at mid-day to shine on the floor of the apartment. A hole in the roof, or perhaps in the wall, would account for this appearance, and coincide with the known usage of times long after this period. Aristophanes makes one of his actors ask, "What is that which makes a noise in the chimney? I am

Charring the fuel was early practised to avoid the nuisance of palpable vapour: and, on this account, Anacharsis praised the Greeks for bringing fire only into their apartments, and excluding the smoke. Wood was also prepared to emit less smoke, by scorching it to extreme dryness in a stove or over the fire. With the same intention, green wood was immersed for a long time in water, and then thoroughly dried, which produced the effect of scorching in a less degree. Sometimes dried woods were soaked in oil, or oil lees, or in bitumen. All these preparations, by enhancing the price, must have limited the use of this kind of firing. Coal, it has been thought, was known to the Greek naturalists. Theophrastus speaks of fossil substances found in Liguria, and in Elis, in the way to Olympia, and used by smiths, that when broken for use are earthy, and that kindled and burned like wood coal.* The general fuel was green wood; and where that was unattainable, other vegetable and even excrementitious substances were used on the hearth for combustibles.† On days of ceremony it was also customary to burn fragrant substances. When Alexander

the smoke, (replies old Philocleon, who wished to escape through the kitchen,) and am endeavouring to get out at the chimney."—Vesp. ver. 139. A hole in the wall or roof explains this passage. The poet Alexis, in the time of Alexander the Great, makes a person inquire, "Boy, is there a kitchen? has it a chimney? Yes, but it is a bad one; the eyes will suffer."—Athenæus, l. ix. This question and reply show that kitchens had not always an opening in the roof. In a passage of the poet Dephilus, a parasite observes, when invited to an entertainment, he looks only to the smoke of the kitchen. "If I see it," says he, "rising up in abundance, quick and in a straight column, my heart is rejoiced, for I expect a good supper."—Athenæus, l. i. The same appearance would be presented by a fire made in a field, or by smoke issuing from a hole in the roof. The poet Sosipater says, a perfect cook "should be able to discover from what quarter the wind comes: for when the smoke is driven about, it spoils many kinds of dishes;"—Athenæus, l. ix.; that is, he should be able to know which kitchen *window* to open that the "smuts" might not be driven into the broth, and spoil it. From these passages it is concluded that the Greeks had no chimneys.—Hist. of Inventions, vol. ii. p. 62, 91.

* Hill's Theoph. p. 63. † Ezek. c. ix.; c. xxiv. 5.

the Great was at an entertainment, given in the winter by one of his friends, "a brazier was brought into the apartment to warm it. The day being cold, and the king observing the small quantity of fuel that had been provided, jeeringly desired his host," says Plutarch, "to bring more wood or incense." The supply of the precious firing appeared to the king too scanty for producing the required warmth; and if it arose from his host being niggardly of the costly fuel, he hinted that some even of the common sort would be acceptable.

Bitumen, a cheap aromatic, was commonly burned to correct the smell from the hearth or the brazier; but costly odorous gums, spices, and woods, were also profusely consumed for the purposes of fumigation. As delicacy of manners made progress, the person, clothing, and habitation of those who could afford it were redolent of perfume. The heat of the climate, the general ignorance of the modern use of linen, the indulgence of many personal habits that appear to us coarse and offensive, the deleterious and unpleasant exhalations from their fires and lamps, and the want of ventilation in apartments, all made sweet odours be considered in the East, not a luxury merely, but a necessary of life. When Agesilaus refused the present of perfumes, sent by Tachos, the Egyptians looked upon the fusty Spartan as a barbarian, unaccustomed to civilized society, and unworthy of its refinements.

With all their ingenuity, the Greeks were but novices in the art of comfort. Though obliged to take great care of his coarse clothes, the Spartan, in his affected contempt for personal indulgence, made no difference in his dress during summer and winter; and living in a house, whose timbers by law were to be formed with the axe only, and the doors with a saw, if his dwelling and clothing were

comfortable in the summer, both must often have been intolerable in the winter. The other Greeks were accustomed to go lightly clad, but as their rooms were well finished, and had doors, shutters, curtains, and carpets, they probably shivered less in cold weather than their Arcadian neighbours. They could also keep themselves warm enough at night, for they had bedsteads, soft mattresses, skins, cushions, carpet-blankets, and coverlets. The beautiful Greek undressed when she went to rest for the night, yet her bed wanted the delicate and refined ventilators—sheets. When she arose from her blanket-covered plane of repose, to array herself in woollen, she had no stays, nor stockings to add to her comfort, and a buckle only, or a skewer instead of a paper of pins, to make her garments air-tight. If this perfumed model of womankind, with her painted cheeks and lips and eyebrows, did not indulge in the luxury of the shift, neither had her lord any shirt, nor drawers, nor hose, nor buttons, nor handkerchief, nor pockets, nor lining to his cloak, nor gloves,—items essential to the perfection of the most common modern portable climate. Their lamps, too, though elegant, were offensive; and if they had wax and tallow pith and rush lights, of candles they were always entirely ignorant. Abroad, therefore, the Greek, during his sharp winter, must often have suffered much privation; and within doors, he never could enjoy artificial heat or light without smoke, and risk of suffocation, for his house had not a chimney; nor, in the cold weather, could he enjoy warmth with daylight in his elegant apartment, for he made no use of glazed windows.

ESSAY III.

When Pompey, says Plutarch, was visiting Lucullus, he blamed him for making his villa so delightful in summer, and yet so uninhabitable in the winter. "Think you," replied Lucullus, "that I have less forecast than the cranes and storks, and that I know not, as they do, how to change my habitation with the season." When this rich and extravagant seeker of pleasure admitted being reduced to the same alternative with the fowls of heaven, in order to insure a genial warmth in his brumal retreat, he exhibited the low state of domestic comfort in a Roman community. Yet, change as he would, he had no means in his winter palace, placed any where, of enjoying a summer temperature in the cold weather, without being inconveniently burdened with clothes, and breathing charcoal vapour, rendered perhaps less offensive by impregnation with costly aromatics. It is clear, from the instructions Vitruvius gives in what manner to decorate apartments generally, that discomfort was not confined to the palace. To hide the unsightly stains of smoke, this architect directs the walls of the rooms in which fires or many lights are burned, to be finished above the *podium* with polished panels of a *black* colour, having red or yellow margins round them; and he advises that delicate ornaments should not be introduced into the cornices, because they are spoiled, not only by the smoke of the house, but also by

that from the neighbouring buildings.* The same architect thus describes the construction of the *hypocaust* or stove for heating the *caldarium* or sweating room of a bath.

The floor is made inclining, so that a ball placed on any part of it would roll towards the fireplace, by which means the heat is more equally diffused in the sweating-chamber. The floor is paved with tiles that are eighteen inches square; and on these are built brick pillars, eight inches on the side, and two feet high, and cemented with clay and hair mixed together. The pillars are placed at such a distance, as will allow tiles two feet square to be laid on them to form the ceiling of the hypocaust, and support the pavement of the *caldarium*. The air to the caldarium, or room over the hypocaust, is admitted through an aperture in the centre of its roof, from which a brazen shield is suspended by chains. By raising and lowering this shield, which opens or shuts the aperture, the heat of the *caldarium* is regulated.†

For heating the water to supply the baths, there are to be three caldrons,—one for hot water, another for tepid water, and a third for cold water; and arranged

* L. vii. c. 3, 4.

From the description he gives of a method of forming the pavement in Grecian winter rooms, his own notions of comfort do not appear to have been very refined. "These pavements," he says, "are not only economical but *useful*. The floor of the *triclinia* or dining room is excavated to the depth of two feet, and when properly rammed, a layer of brick rubbish, made to slope towards a drain, is spread over it. Upon this is laid a cement of pounded coals, sand, ashes, and lime, half a foot thick. The surface being made flat and smooth, and then polished with a stone, has the appearance of a black pavement. The liquor that is spilt at the banquet, and the expectoration that falls on it, immediately dry up, and the attendants on the guests, though barefooted, do not suffer from cold on this kind of pavement."—L. vii. c. 3. At the present time, drained floors are formed only in the triclinia of cows, horses, and other beasts.

† Vitruvius, L. v. c. 3. In some cases these circular shutters or valves seem to have condensed the vapours with great rapidity, and causing them to fall in showers, kept the pavement under them constantly wetted. The apartment must at all times have been very gloomy, and the darkness must have increased with the rise of temperature.—Gell. Pompeiana, vol. ii. p. 121.

so that as the hot water runs out of the lower vessel, it may be replaced from the tepid vessel, and that in like manner replenished from the cold vessel: the arched cavities in which they stand are to be heated by one fire.*

After such minute instructions how to form the stove in which large quantities of wood were to be consumed, it is singular that he should omit to notice in what way the smoke produced was to be conveyed into the atmosphere. From this silence, it has been inferred that he was ignorant of what Anderson calls "the elegant and commodious tube now known by the name of a chimney." It is not, however, a fair objection to his skill in contrivance, that, although sensible of the inconvenience of discoloured walls and smoke-filled rooms, he should nowhere suggest the use of a hypocaust to avoid the nuisance. For this presupposes that the urgency of a want will prompt an invention to supply it, when all experience shows that even the most obvious improvements oftener arise from accident than reflection. It is certain, however, that such structures were sometimes built without chimneys. An ancient bath yet remaining in the island of Lipari has a small opening at one end of the hypocaust, for the admission of firewood, and a similar one at the other end for the exit of the smoke.†

About sixty years after the period in which Vitruvius flourished, hypocausts are first noticed, as being employed for heating domestic apartments. "Many inventions (says Seneca) have been divulged within my memory,—such as windows formed of a transparent plate, also suspended baths, and pipes from hypocausts, so inserted into the walls as to spread an equal warmth through the room, and heat what are beneath, as well as what are above."‡ The apparatus

* Vitruv. B. v. c. x. † Smith. Archæol. vol. xxiii. p. 100.
‡ Ep. 90.

here so briefly mentioned may have been arranged in this way. The hypocaust being constructed in the under story of a building, in the manner described by Vitruvius, several pipes of baked clay were then built into the walls, having their lower ends left open to the hypocaust. These pipes were carried to the height of the first or second story, and had their upper orifices made to open into the chamber that was to be heated. They were closed by moveable covers.*

While green wood was burning in the furnace, and the hypocaust filled with its acrid smoke, the covers were not removed from the caliducts; but as soon as the wood was charred, the upper orifices of the pipes were opened, and the hot vapour from the hypocaust then flowed into the chamber. If, as some imagine, it was used in this manner, it is clear the contrivance had all the inconvenience and danger of the brazier,

* Winkelman, in his Letters on Herculaneum, describes the ruins of a villa discovered near Rome that had pipes placed in the walls in a somewhat similar way. "Stoves (or hypocausta?) were found, he says, in the apartments. Below these apartments there were subterraneous chambers about the height of a table, two and two under each apartment, and close on all sides. The flat top of these chambers consisted of very large tiles, and was supported by two pillars, which as well as the tiles were joined together, *not with lime*, but with some kind of *cement*, that they *might not be separated by the heat*. In the roofs of these chambers there were square pipes made of clay which hung half way down into each, and the mouths of them were conveyed into the apartment above. Pipes of the like kind built into the wall of this lower apartment rose into another in the second story, where their mouths were ornamented with the figure of a lion's head formed of burned clay. A narrow passage of about two feet in breadth conducted to the subterranean chambers, into which coals were thrown through a square hole, and the heat was conveyed from them by means of the before-mentioned pipes into the apartment immediately above, the floor of which was composed of coarse mosaic work, and the walls were encrusted with marble. This was the sudatorium. The heat of this apartment was conveyed into that on the *second* story by the clay pipes enclosed in the wall, which had mouths opening into the former as well as the latter, to collect and afford a passage to the heat, which was moderated in the upper apartment, and could be increased or lessened at pleasure." Rooms were sometimes built over the sudatorium to participate in its heat. Cicero, in a letter to his brother Quintius, tells him, that he had removed the seats into another angle of the dressing room, because their stove from whence the fire proceeded was under the bedchambers.—Ep. ad Frat. l. iii. ep. i.

without its portability and economy; yet, if adopted to use the superfluous heat only of the hypocaust after the pavement of the apartment over it was sufficiently heated, the plan might be considered an improvement, by those to whom charcoal vapour was not offensive. But had the upper orifices of the caliducts been kept closed until all the fuel in the furnace was consumed, and had then been opened, the method would have been freed from objection. The current of air entering through the furnace, would have had its temperature raised by coming into contact with the hot ceiling, walls, and piers of the hypocaust, and rising through the caliducts would have flowed into the apartment, and have ventilated as well as warmed it.

Glass must have been long known to the Romans through their intercourse with the Egyptians; but talc is considered to have been the "transparent plate" that Seneca alludes to as having been introduced as a weather screen within his recollection.* It

* "The want of the thin plates of glass now used for the purpose of glazing windows, only permitted the ancients to throw into apartments a considerable body of light by exposing them at the same time to every inclemency of the weather; or to protect them against wet and wind by excluding, in the same proportion, all day-light, and contenting themselves with the dim glare of lamps. In general, it caused them to seek a medium between the two extremes of suffering a few straggling rays of light to penetrate athwart the ends of the rafters that lay on the wall, and formed the ceiling; or by introducing immediately under the shelter and projection of the eaves, a sort of wide low window, which only commencing, for the sake of restricting its perpendicular opening and permeability, high from the floor, afforded no view of external objects. These *restraints influenced the whole of their architectural system.* It caused smaller temples to receive the requisite light through an enormous entrance door always open; and the larger ones to remain open roofed. It caused the dwelling-house, for seclusion as well as for safety, to shun all windows outside, to have every aperture for light, as for egress, turned inwardly to a vast open court, and only to present to the street, instead of the multifarious windows of modern habitations, an impenetrable dead wall. It even caused so many apartments of every sort to be left, for warmth as well as comfort, entirely destitute of windows or apertures for daylight of every description, that in the baths of Titus, the fine group of the Laocoon was found in a room which, however glittering with precious marbles, depended entirely for the light that made them visible on artificial illumination.

is related of Caligula, that while giving audience to Philo, a rich Egyptian Jew, he attended to nothing but new glazing his windows; and it has been conjectured that they had previously been glazed with talc, which the emperor was replacing with glass, as a more elegant material, and one better adapted to the purpose. Pellucid shutters, whether of glass or talc, quickly became common; and Seneca, who remembered their first introduction, states, that, at the time he was writing, a man was considered to be poor, who had not transparent windows in his dining room; and that glass had grown so fashionable an ornament, that the public baths had their walls lined with crystal and Thasian marble, for decorations.

Since the invention of fire and clothing, the most valuable gifts to health and enjoyment were assuredly glazed windows and hypocausts. Yet these memorable innovations on ancient discomfort—the most indispensable, agreeable, and enlivening among the refinements of domestic life—were, nevertheless, considered to be prejudicial to health. The man, says Seneca, who screens himself from the cold wind by his glazed windows, whose feet are kept warm by wrapping them in folds of flannel, and who never sups but in his stove-heated chamber, is not without danger of illness on the slightest change of the weather.* And live they not against nature, he asks, that long for a rose in winter, and endeavour by apt changes of heat to make lilies and flowers to blow at that season, instead of in summer.†

Indeed it seems to have *influenced the whole domestic system of the ancients*. By diminishing the difference either between the inside or the outside of the house, or between day and night, it caused them to transact much of their daily business in the public place or forum, and at home to make the night, much more the time of their most retired studies or their most convivial meetings."—Hope. Historical Essay on Architecture, p. 112.

* De Providentia.

† Epist. 122.

The excavations at Pompeii have thrown a clear light on the domestic arrangements of this period. The *villa suburbana* had a large bow window glazed with a green tinged glass, and a window in the baths had good plate glass ground on one side to prevent persons looking through it. But notwithstanding these instances, and that transparent shutters were not rare, window glass was not a common material at Pompeii, nor in Italy. Its scarcity and expense, and late introduction, must have confined its use to the wealthy; and even in their houses, to the rooms appropriated to the reception of company; and linen, horn, and talc, were most likely the substances commonly employed to form diaphanous weather screens.* The Italians, like the Egyptians, made their window openings very small. They were considered better for the eyes than larger apertures.† But the preference was, perhaps, established as much from their being easier filled and made weather-tight in the winter, with the transparent materials at their disposal, as from their better excluding heat and light, in seasons when their excess was oppressive. Some windows discovered at Pompeii were not more than 23 inches wide and 3 feet high; they were fitted with lattices, and had shutters that slided horizontally; which not being very well put together, the gaping chinks had been covered by an inside curtain.‡ Upper floor windows had curtains only; and door openings were often closed in the same manner. The doors moved

* Gell. Pompeiana, vol. ii. p. 97.—The accounts remaining of the scarcity of glass among the ancients are very contradictory. Glass ornaments abounded in Italy at this period, and vast collections of bottles, glasses, cups, vases, and other utensils were found at Pompeii. Yet Vopiscus accuses Firmus the merchant, whose riches enabled him to contest the sovereignty of Egypt with Aurelian, of luxury, for having glass windows in his villa. Glazed windows never have been general in Italy. Even now, except in the houses of the great, the lighting of a house in Italy on a rainy or windy day is very defective.

† Cicero ad Attic. l. ii. ep. 3.

‡ Gell. Pomp. vol. i. p. 164.

on pivots, and were sometimes hung to shut of themselves. The Pompeians had carpets, raised bedsteads, mattresses stuffed with Gaulish wool, down pillows, blankets, and carpet coverlets, and these elements of warmth and comfort were probably enjoyed by all Italians. The general method of procuring a warm indoor climate was by burning charcoal, in a brazier on the pavement in the middle of the room, and allowing the vapour to exude at the door and window.*

These braziers and tripods, formed of all sizes, in iron and bronze, occasionally displayed great elegance of design and neatness of workmanship, and sometimes were contrived to heat water. One of this description, in the museum at Naples, is 28 inches square, and has four towers, one at each angle, fitted with a lid that can be raised by a ring. The fire-hearth is placed in the square part in the middle, which is lined with iron, as in the common braziers. The fluid to be heated was contained in the towers.†

It is supposed this *foculare* was intended to "heat water and other liquors, for family uses," as well as to warm the apartment, though it seems far from being either a convenient or an economical apparatus for these purposes. Another use of such utensils has perhaps been overlooked. The cold dry air of an Italian winter and spring was desiccated to a high degree after being expanded by the heat of a hypocaust, or a fire of charcoal; and these braziers appear a very elegant method of diffusing that quantity of

* "In the kitchen of the house of the Dioscuri, the smoke might have escaped by a little window yet existing; no trace of a chimney is visible, yet it seems impossible but that there must have been one, It is certain, however, that in a small shop, and in a chamber of the Temple of Isis, chimneys may be found at Pompeii."—Gell. Pompeiana, ii. vol. ii. p. 164.

† Sir William Gell gives a figure of this brazier in his Pompeiana, vol. i. Another of most elegant design, is represented in Donaldson's Pompeii Illustrated, vol. ii. The bronze brazier that was placed in the *Tepidarium* of the Baths at Pompeii, is described and figured in the Museo Borbonico, vol. ii.

moisture in the air of an apartment, that was necessary to make it agreeable and salubrious. Perhaps the evaporation was partially regulated by shutting or opening the lids of the water vessels.

The *caldarium* of the public baths had a hypocaust formed beneath it, and its walls were so constructed that heated air surrounded the apartment on all its

FIG. IV.

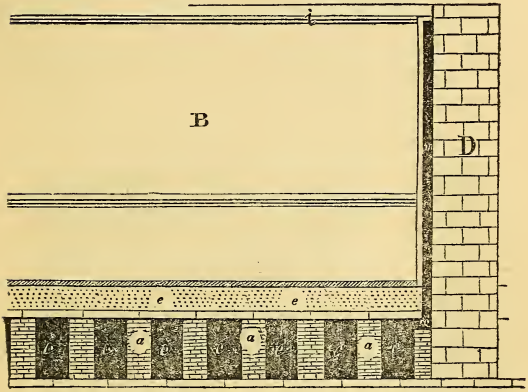
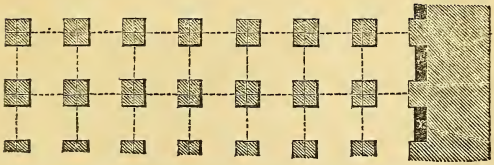


FIG. V.



sides. Fig. IV. is a section showing part of the walls and floor of the caldarium, and Fig. V. is a plan of the same portion.*

A foundation for the floor was prepared by laying

* Museo Borbonico, pl. 51.

a thick stratum of cement, composed of lime and pounded bricks. On this were built small brick pillars, *a*, about 9½ inches square and 19 inches high; strong tiles, *c*, were then placed on these pillars to form the ceiling of the hypocaust, and over them was spread a stratum of cement, *e*, about 9 inches thick. The surface of this pavement, ornamented with mosaic, formed the floor of the caldarium, B.

The sides of the caldarium, as high as its cornice, *i*, were formed hollow, by means of tiles, *m*, 1¼ inch thick, placed at a distance of 3 inches from the outer wall, D, and firmly attached to it by iron cramps, *n*, passing through holes, made at each corner of the

FIG. VII.

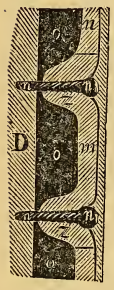
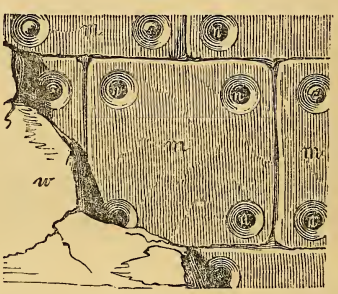


FIG. VI.



tile. These holes appear to have been perforated, after the tile had been moulded, by an instrument somewhat blunt being thrust into the mass while soft, which, protruding the clay, formed a hollow projection, *z*, on the opposite face of the tile. Each tile had four of these hollow projections, through which the iron cramp, *n*, was driven into the outer wall, D, of the caldarium.* The hollow knobs thus served as sheaths to protect the cramps, *n*, from the heat, and as

* Museo Borbonico, vol. ii. p. 27.

stays to preserve the space *o*, between the inner surface of the tile, *m*, and the wall, D. A substantial stucco was laid over the tiles to receive the decorations appropriate to the apartment, which, filling up the joints, made the casings smoke-tight. The space, *o*, formed between the outer wall and the tiles, communicated with the hypocaust, between the pilasters, under the floor, as is shown at *x*. The furnace was placed in an area at one side of the hypocaust, and the flue by which it communicated with the hypocaust, was placed nearly in the middle of its side.

Figure VI. shows the face of the lining tiles, *m*, on a larger scale, which in Fig. VII. are shown in section. The same letter, in the preceding figures, refers to the same part.

When the hypocaust or stove was filled with the hot smoke from the furnace, the vapour rose into the space *o*, between the tiles and the wall, and formed a column, or rather a lining, of heated air round the caldarium as high as its cornice, by which means the walls, as well as the floor, of the apartment could be kept at a high temperature. In constructing this hollow wall there does not seem to have been an intention of making the hot vapour, that ascended into the space *o*, *circulate* throughout the interval, although without this circulation much of the effect that would have been produced by this skilful arrangement was thrown away.

Adjoining the caldarium was the *tepidarium*, a room kept at a moderate temperature only. It had a capacious flue, running the whole length of the floor and communicating with the hypocaust of the caldarium, and also with the furnace; but it was heated solely by a large bronze brazier, placed at one end of the apartment. This vessel was 7 feet long, 2 feet 6 inches wide, and lined with iron to protect the bronze from

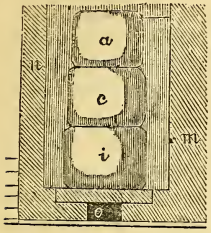
the action of the fuel; and the bars at the bottom were of brass, on which bricks were placed to support the pumice-stone for the reception of the charcoal. The introduction of this brazier into the tepidarium shows the force of prejudice in favour of the common mode of warming by a pan of charcoal. In the caldarium a much higher temperature was necessary than in the tepidarium, and this was obtained from the hypocaust and hot wall, without the room being filled with the fumes of charcoal; a comfort that might also have been enjoyed in the tepidarium by means of the flue formed under the pavement. It is not quite certain, however, that the suffocating vapour was at all times excluded from the caldarium itself, notwithstanding its great surface of hot floor and hot wall, that under modern management would have sufficed not only to "diaphorise, but to bake the Pompeians." Gell observed a stone in its floor that was moveable, and was probably placed there to be occasionally lifted to permit a current of hot air from the hypocaust to enter the caldarium.*

The form and proportions of the caldrons that heated the water for the bath are given in Fig. VIII. from the impression very visibly remaining in the bed of the mortar in which they had been fixed. The caldrons were arranged one above another, and set in a kind of oven, without flues running round them, and were named, like the chambers, according to their temperature and use; the lowest, next the fire, *i*, was called the caldarium; the next, *c*, was the tepidarium; and *a*, the upper caldron, was the frigidarium: *m* is the wall of the bath; and *n*, a wall enclosing the boilers; *o*, the flue of the furnace. By means of a syphon, when boiling water was drawn off from the caldron of boiling water, *i*, it was

* Gell. Pompeiana, ii. vol. i. p. 120.

refilled with warm water from the middle one, *c*; and this vessel in its turn was replenished with colder water from the uppermost boiler, *a*, into which cold water flowed from the cistern.*

FIG. VIII.



The matrice or bed of one column only of caldrons was found; but, as it was seldom necessary to have more than one fire in the baths to warm both the rooms, and the water; it is thought that three columns of boilers (nine vessels) were placed over the same fire in one oven.†

Where a large quantity of water was wanted, heating it in boilers on this plan, would appear to be nearly impracticable; and the magnificent baths at Rome, it has been conjectured, were heated in another manner.

A series of hypocausts was constructed after the method described by Vitruvius; and similar to the stove under the caldarium in the baths at Pompeii. Upon these stoves ranges of substantial vaulted stuccoed water tight chambers were built one above the other, into the walls of which were inserted earthen pipes, that communicated with the hypocausts beneath.

The vaulted roof of the tier of chambers was formed into a shallow reservoir, that was left open to the air; and into this cistern the water from the public aqueduct was conducted to have its temperature raised as much as possible, by exposure to the sun, before it was allowed to fall into the water chambers beneath it.

* Gell. Pompeiana, vol. i. pl. xxv.
† Ibid. ii. vol. i. p. 129.

If both ranges of chambers, and the reservoir forming their roof, be supposed filled with water, and fires made in the hypocausts, the floors of the lower range of chambers will be heated, and the smoke rising through the earthen pipes from the hypocausts heating the walls, the water contained in these lower chambers will have its temperature raised also. This will then communicate heat to the floor of the second tier of chambers, and warm the water standing on it. The operation is the same as that of the caldron apparatus. As the hot water from the lower range of chambers is drawn off for the supply of the baths, the tepid water in the second range descends and replaces it; and, at the same time, the water that has been slightly warmed by exposure to the sun in the shallow reservoir on the roof, falls into the tepid water chambers.

FIG. IX.

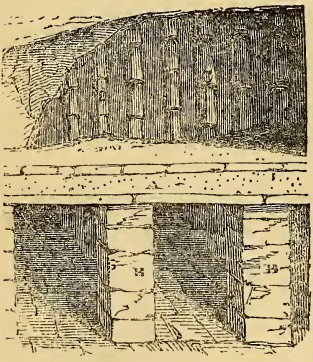


FIG. X.

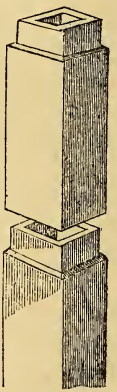


Figure IX. is a section of a portion of one of the hypocausts. B B, the piers; A, the floor of the hot water

chamber. The way in which the pipes were placed in the walls, is seen at c, a part where the stucco had fallen down, when Piranesi made his sketch from which the figure was taken.*

One variety of the earthen pipes that were built into the walls is represented in Figure X. They were about 1¾ inches thick, and fitted into each other with a sort of spigot and faucet joint that lapped about 2 inches. Another sort was cone-shaped, and, when placed in the wall, the narrow end of the one was inserted about 2½ inches into the wide end of the other. Some were made cylindrical, others were parallelopipedons, and, when used in the building, their ends were merely placed in contact. The drains that conducted underground the hot water from one part of the bath to another, were sometimes formed of these earthen pipes cased with bricks; and to prevent the water being cooled as it flowed through them, the drain or conduit was surrounded by a flue, that led from and communicated with the hypocaust, or, when it had one, with its furnace. They were thus enclosed in the centre of a hot funnel, and could by this means be heated before the water entered, and have their temperature preserved, while it was running from the caldrons.

In some ancient baths that stood where is now the church of St. Cecilia in Trastevere, the same end was attained by another method. To diminish the dispersion of heat by radiation, the copper tubes that served for flues or pipes were gilt at those parts where they were exposed to the atmosphere.†

Cameron, who considers the method of heating water in chambers of masonry to be feasible, gives some illustrations drawn from the remains of the baths of Caracalla. In these magnificent *thermæ*, he

* Cameron. Baths of the Romans.
† Ibid. p. 36.

states, there are twenty-eight chambers placed in two rows, of fourteen on a side, built over a hypocaust. Each chamber being constructed, as he expresses it, "on the principle of Papin's digester," about 49 feet 6 inches long, 27 feet 6 inches wide, and about 30 feet high, will contain 40,837 cubic feet of water spread over 1,361 feet of floor, heated by the hypocaust beneath it. The whole heating surface will, therefore, be 19056 feet, having 1,143,450 feet of water standing on it, to have its temperature raised, on an average, 35° in summer, and 52° in winter; and to be kept at this heat for three hours, together with the thick walls and floors of the water chambers, and the pillars and walls of the hypocausts. When we take into account this immense mass of wall, pavement, and fluid to be heated by wood fires made under floors, varying in thickness from 13 to 20 inches, composed of such imperfect conductors as tiles and cement, and extending over a surface of 19,056 feet; and if we reflect also on the defective construction of the heating chamber, and the enormous waste that this alone must have occasioned of a scarce and expensive fuel, the greater part of which had to be brought from Africa;* the certain practical difficulties attached to the plan will appear so great, that it is probable the hypocausts in these baths were intended only to preserve the temperature that was given to the water contained in the chambers above them by some other apparatus, with which, however, the moderns are unacquainted.

That contrivance is conjectured to be alluded to by Seneca, when he speaks of *dracones*, or small thin brass pipes made in a winding or serpentine form, and placed in a fire, so that water entering cold at one end of the pipe or *draco*, from its convolutions through

* Symmachi Epist. l. 10. ep. 58.

the furnace issues boiling at the other extremity; by which means, as the water could be made to boil in a vessel not connected with the fireplace, a bath could be heated in any situation. In some cases a *milarium* formed part of the heating apparatus. What this was is uncertain. Some interpret the term to express a combination of caldrons like that described in a preceding page;* while others consider it to designate a kind of reservoir connected in a certain manner with the coiled pipe or draco.

According to this guess, which, whether correct or erroneous, gives us a glimpse of a most ingenious invention, the milarium was a leaden vessel of considerable dimensions, containing water. In the middle of this reservoir was a furnace that had its bottom and sides formed of brass. The dracones, or thin brass pipes winding round the inside of this furnace, were enveloped by the flames. One end of the draco was inserted into the milarium near its bottom, and the other near its top. The water entering at the lower orifice was discharged hot from its upper end, and the entire mass in the milarium was heated by this circulation in the draco.

Thermæ of a large dimension might have had several milaria connected with them, but those of moderate capacity, and more especially private baths, were probably sufficiently supplied with one. Its great value to the Romans arose from the facility it gave of heating elevated or hanging baths. In these structures it was a principal object not only to have them as large and commodious as those placed on the ground, but to insure an extensive prospect to the bathers. The milarium put this in their power. The draco could be carried from a furnace below to any

* Baccius. De Thermis, p. 443.

height, and it was a more manageable and compact apparatus than a hypocaust, if erected on an upper floor.

A figure of the draco copied from an ancient painting, agrees nearly with the preceding description,* and a diagram of it given by Castel a century ago seems to have been the type of a meritorious modern revival of the ancient apparatus.†

The ignorance of a salubrious and effective system of warming apartments among the Romans, is well exemplified by the solicitude shown by the younger Pliny, to turn to profitable account a source of heat that is neglected in modern buildings, as one which no ingenuity could make adequate to the lowest want of domestic comfort.

The villa Laurentinum was situated on the sea coast, about seventeen miles from Rome, and although not extensive, it was large enough to afford every desirable accommodation. From the station, and taste of its owner, and being built for habitation during the winter months, it most likely contained all the conveniences for heat and ventilation that were to be found in the houses of men of the highest rank in Rome.

From a plain porch, says Pliny, you enter a portico of the form of the letter O, which includes a small but agreeable area. This affords a pleasant retreat in bad weather; as it is not only enclosed with windows, but sheltered by an extraordinary projection of the roof. From the middle of the portico you pass into a handsome hall, that has folding doors and windows on every side. On the left of this apartment lies a large drawing-room, and beyond that a second of a smaller size, having one window to the rising and another to

* Cameron. Baths of the Romans, p. 42.
† Castel. Villas of the Anc. p. 36.

the setting sun. The angle that the projection of the hall forms with this drawing-room, retains and adds force to the heat of the sun. To this warm corner, continues Pliny, my family resort in winter to perform their exercises; for, sheltered from all winds, except those which are generally attended with clouds, nothing renders this spot useless but what, at the same time, destroys the fair weather. Contiguous to this is a room that juts out and forms the segment of a circle; the windows of which are placed so as to receive the sun the whole day.* From hence you pass into a bedchamber, through a passage which, being boarded and suspended, as it were, over a hypocaust beneath, tempers the heat which is emitted, and conveys it to all parts of the bedchamber.

In the opposite wing is a room ornamented in a very elegant taste; adjoining is another room that, though large for a parlour, makes but a moderate sized dining-room. It is exceedingly warmed and enlightened, not only by the direct rays of the sun, but also by their reflection from the sea. Beyond is a bedchamber with its ante-room; its height renders it cool in summer, and being sheltered on all sides from the wind makes it warm in winter. To this a similar apartment is joined by a party wall. From thence you enter into a handsome and spacious cooling room belonging to the bath, contiguous to which

* A room constructed in this form, and for the same purpose, was discovered at Pompeii.

"The *cubiculum*, with the bow window, was doubtless the principal one in the villa; having the ends towards the country circular, it continued to receive the full influence of the sun from the dawn to the close of the day. When the shutters were closed, light was admitted by bull's-eyes over the windows. The alcove in the middle of the chamber was enclosed by a curtain. On one side is a recess hollowed out of the solid construction. This was probably the toilette, as it contained several vases which apparently had contained perfumes and unguents."—Donaldson. Pompeii Illustrated, vol. ii. p. 30.

is the perfuming room, then the sweating room, and next to that the furnace which conveys heat to the bath; adjoining are two small elegantly fitted up bathing-rooms, and next to them is a warm bath, wherein one may swim, and at the same time have a prospect of the sea. Near it is the tennis-court, that lies open to the warmth of the afternoon sun. From thence you ascend a sort of turret, containing two entire apartments below, as there are the same number above, besides a dining-room, which commands very extensive prospects. At the other end is a second turret, in which is a room that receives the rising and setting sun. Behind this is a large repository, and near it a gallery of curiosities; and underneath a spacious dining-room, where the breaking of the waves is heard but faintly. From the banqueting-house in the garden an enclosed portico extends, which has a range of windows on each side; but on that which looks towards the sea, they double in number those next the garden. These are all thrown open when the weather is fair and serene; but if it blows, those on the side the wind sets from are shut, while the other remains open without inconvenience.* The portico itself is coolest when the sun is most scorching, that is, when its rays fall most directly upon its roof. By setting open the windows, the western breezes have a free draught, and prevent the enclosed air from stagnating. At the upper end of the portico stands a detached building, which I call my favourite. It contains a very warm winter room, one side of which looks upon the terrace. The other has a view of the

* Ventilating by opposite apertures seems to have been well understood. Varro, De Re Rustica, l. i. c. 5, tells us how several cities in Greece were preserved by Hippocrates during a pestilence, and of great cures done by himself in a parallel case at Corcyra, by no other knowledge than that of rightly disposing the apertures of the houses.

sea; and both lie exposed to the sun. Adjoining this is a bed-chamber, which neither the voice of the servants, the murmuring of the sea, nor even the roaring of the tempest, nor lightning, nor the day itself, can penetrate, unless you open all the windows. Annexed to this is a small hypocaust, from which, by opening a little aperture, the heat is let out to warm the bed-chamber to the degree required, and beyond this lie an ante-chamber and chamber that also enjoy the sun, though obliquely, from the time it rises till the afternoon.*

Thus far Pliny, who, it is manifest, made warmth a principal consideration in the construction of his villa, and delighting in warm apartments, took all opportunities to have the benefit of the sun both within doors and abroad, as much and as long as possible. To enjoy his beams the whole day, he formed one end of his dining-room like that curve which he thought the glorious luminary made in his course round the world, and when obliged to make projections in his building, he contrived them so as to form a warm corner for his family to take exercise in, since no fires were made in the house, except in the kitchen, and in his own apartments. His sleeping-room was placed to have the benefit of the morning sun; and to remedy the inconvenience of its being situated in a cold corner in the winter, he warmed it from a hypocaust under a small room adjoining, as being more convenient for a servant on the outside of the chamber, to admit what heat was necessary, without disturbing the person that was asleep, than if it had been made under it. He shows no care to heat any other room in this winter villa, except his bed-room in the garden-house, as if he chose rather to keep himself warm by

* Ep. l. ii. ep. 17.

additional clothing, or by exercise, or by retiring to those rooms which were warm by their position, than by the heat of a hypocaust. Our ignorance of ancient manners, and deep-rooted prejudices imbibed during that period of our lives when we generally read the classics, have taught us to think very highly of Roman magnificence, and luxurious enjoyment; but, in this instance, Pliny himself admits that real comfort could only be found in his little bedchamber in the pleasure-house in the garden, a room that would now be considered most dismal in the winter by a modern domestic, for its small window was closed with wooden shutters only.

It may here be observed, that, in general, the arrangement of a Roman house was such that the sun could shine through the *compluvium* or the opening in the roof of the *atrium* or hall; and being commonly only one story high, and rarely exceeding two, it must have been warmer and drier than houses of the present day, that preserve something of the ancient form, but where the court is usually darkened and rendered damp and chilly by the greater height of the surrounding buildings. In town houses, however, the rooms must have been very gloomy, as the only light they could receive entered through an aperture in or over the door, and even this light was often borrowed. Under these circumstances the ventilation must have been most imperfect; and in spite of their use of talc, glass, and linen shutters, and of curtains, carpets, and braziers, still the want of fires generally, and chimneys entirely, must have reduced the ancient inhabitants of Italy, as it does the modern population, to endure, under additional clothing, that state of discomfort and cold damp which is always produced whenever the sky is overcast between November and April. Yet no people are

more sensible of the slightest variation of temperature than the Italians; and none make a more plentiful use of warm clothing. They also know the use of chimneys; but popular as well as professional prejudice prevents their introduction; and people who follow the rules of their physicians, *avoid* them, and live in rooms warmed by pans of burning charcoal set on the middle of the floor, or under the table at which they sit, without a funnel of any sort to carry their fumes out of the apartment,—but such has been the custom in Italy from the most ancient times.

In the cold and changeable climate of Britain, the Romans adopted a more economical and healthful method. Almost all the remains of their houses that have been discovered, show that the means of heating them by hypocausts and flues were provided at the erection of the building, not for one or two rooms only, as in Pliny's Laurentine villa, but for every apartment designed for habitation by the family.*

These hypocausts are of two kinds. The first con-

* The hypocaust at Withington was 27 feet 6 inches in length, and 19 feet wide. The piers were formed of brick, 8 inches square, and the average distance between the piers was 14 inches.—Archæologia, vol. xviii. p. 112.

At Caerleon, the piers were built of circular bricks, 14 inches in diameter, "piled on each other like cheeses."—Roy. Military Antiq. p. 197. Arch. vol. ii. p. 6.

The pillars of the hypocaust at Wroxeter were formed of fragments of columns of granite that had before been used for some other purpose, 14 inches diameter. There was much irregularity both in the distance and placing of the pillars. In the same villa two other hypocausts had pillars 8 inches square, 2 feet distant from centre to centre.—Phil. Trans. No. 306. Arch. vol. ix. p. 326.

The hypocaust at Cirencester was 32 feet long, by 24 feet wide, and had pillars 8 inches square, with tiles for bases and capitals, 11 inches square, on which rested tiles 2 feet square, and on them others of the same size to receive cement for floor; pillars 2 feet 3 inches asunder. —Arch. vol. vii. p. 407. A plan and sections of this hypocaust are given in Carter's Ancient Architecture, p. 7.

Roman house at Rodmarton. Piers of the hypocaust were 21 inches high, and 8½ inches square; spaces between the piers from 7 to 10 inches. They were of brick, and the mortar joints were ¾ of an inch in thickness.—Arch. vol. xviii. p. 115.

In the remains of a Roman building on the river Eske, five out of the seven rooms had hypocausts under them, constructed in the

structed with flues running under the floor of an apartment, and heated from a fireplace made on the outside of the building; and the second kind formed like a low chamber, having its ceiling supported by small pillars as described by Vitruvius, or by dwarf walls, and sometimes having flues leading from them under other apartments. The hypocaust discovered at Lincoln will explain this variety, of which Figure XI. is a ground plan, and Figure XII. is a section. The same letters on both Figures refer to the same part.*

The hypocaust was 24 feet 6 inches long, and 9 feet 6 inches wide. It contained four rows of brick pillars, *a*, *a*, *c*, *c*, two of which were square, and two circular. The square pillars, *a*, *a*, were 8 inches on the side, and about 9 inches apart; the circular props, *c*, *c*, were 11 inches in diameter. Each pillar had a projecting brick or tile about 11 inches square for its base, and another tile of the same size that formed a capital, making its height, and that of the heating chamber, about 26 inches. Large bricks, *e*, *e*, varying from 16 to 20 inches square, and 2 inches thick, were laid on the pillars to form the ceiling of the hypocaust. On these were placed courses of tiles, bedded in mortar, and on them a layer of stucco, to form the floor of the room, *z*, to be heated; the entire thickness of the floor being about 10 inches. The fire-hearth was at *i*; and the flame and smoke

usual manner with flues, and heated from the outside.—Roy. Mil. Antiq. pl. 46. King. Munimenta Antiqua, vol. ii. p. 182.

In the Villa Rustica, adjoining the villa at Bathorne End, the flues of the hypocaust were 18 inches deep, and 14 inches wide. At the extremity of every flue, within 3 or 4 inches of the top, a brick funnel was placed in the wall.—Rooke. Arch. vol. ix. p. 205.

Hypocaust at Chester. Had thirty-two pillars, 2 feet 10½ inches high, 18 inches distant from each other, standing on a mortar floor, spread on the rock.—Pennant. Tour in Wales, p. 2.

At Dover, the pillars of a hypocaust were 20 inches high, 9 inches square, and 15 inches apart.—Arch. vol. v. p. 327.

The pillars in an ancient bath at Lipari were 2 feet high.—Arch. vol. xxiii. p. 100.

* Vetusta Monumenta, vol. i. pl. 47.

passed through the arched cavity, or throat of the furnace, *e*, into the hypocaust. Two flues, *m*, *n*, opened into the hypocaust. The flue, *m*, that pro-

FIG. XI.

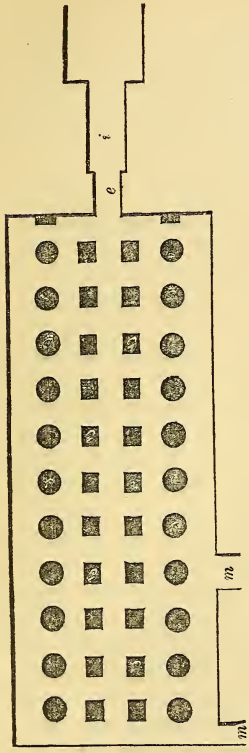
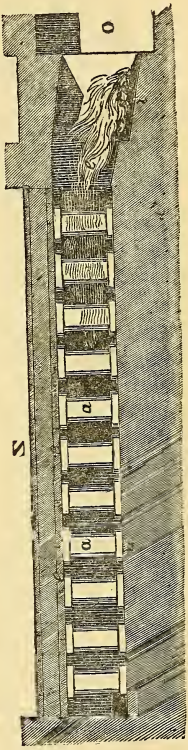


FIG. XII.



bably conducted the smoke under some other apartment, was about 6 inches high, and 14 inches inside. Its bottom was raised about 2 inches above the floor

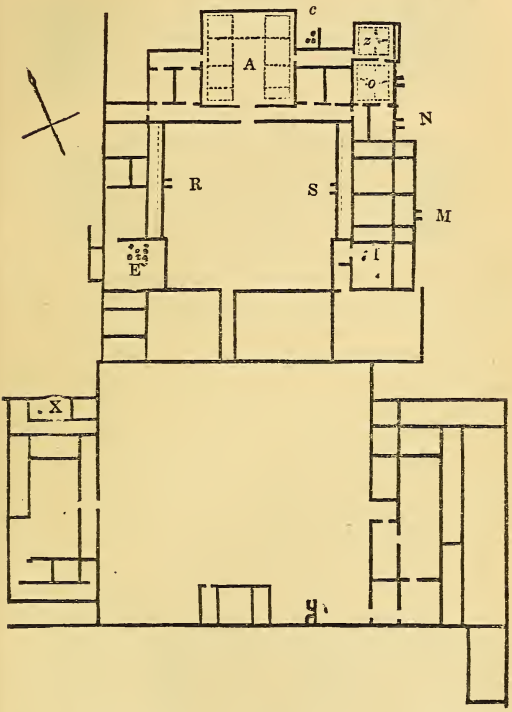
of the hypocaust. The flue, *n*, was about 6 inches square, and placed as much under as above the floor of the hypocaust. This seems to have been a smoke flue. The position given to these flues was, perhaps, designed to retain at all times the hottest portion of the vapour in contact with the ceiling of the hypocaust; and in the want of a contrivance like our furnace doors and dampers, this was an effective and ingenious arrangement. The floor of the præfurnium, A, was 18 inches under the level of the floor of the hypocaust.

The villa at Woodchester, built, it is conjectured, by order of the Emperor Adrian, was, according to King, the noblest of the kind existing in Britain. It contained sixty-five apartments, nineteen of which were of good proportion.* All the rooms and passages in the main building were heated by hypocausts, or by flues. Figure XIII. is a plan of the walls of this villa, and will clearly explain the general arrangement of its apartments.† The room A, the largest, and, judging from its beautiful mosaic floor, the most magnificent in the villa, was a square of 48 feet 10 inches. It opened into smaller chambers on two sides, and on the third side into a corridor or gallery that formed a communication with the other rooms in the main building. Under its elaborate mosaic pavement ran four flues, that are shown by the dotted lines, crossing each other at right angles, built of stone, and plastered, and covered with thick unwrought stones. The floor was coated with a coarse tarras. The flues were 4 feet high, 23 inches wide at bottom, and in the middle of their length had the same width at top; but as they approached the walls of the apartment they gradually diminished at top to a width

* Munimenta Antiqua, vol. ii. p. 188.
† Lysons. Roman Antiquities at Woodchester, pl. vi.

of 6 inches. The flues that ran from front to back had brick funnels placed in the walls at their extremities. These funnels were $13\frac{1}{2}$ inches wide, $4\frac{1}{2}$ inches broad on the outside, 18 inches long, and

FIG. XIII.



about an inch thick. They were deeply furrowed on one side with lines made with a toothed instrument when the clay was moist, and were most likely intended to make the mortar adhere more firmly to

them. It was remarked that these flues, (shown in Figs. XIV. XV.,) were not discoloured by smoke, and could not, therefore, have communicated with the hypocaust,

FIG. XIV.

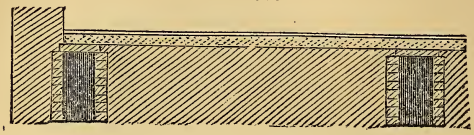
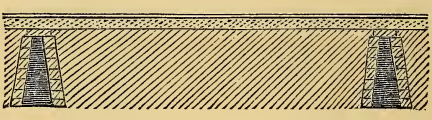


FIG. XV.



c, that adjoined them. They had probably been used only occasionally to convey hot air to prevent the effects of damp on the magnificent floor they ran under.

Flues, 4 feet deep, and 1 foot 11 inches wide, and crossing each other at right angles, were formed under the floor of the room o. Figure XVI. is a plan of the room and its flues; and Figure XVII. a section of its flues taken through the fireplace. In both figures, *a* is the fire-hearth; it was 1 foot 11 inches wide, and projected 4 feet 2 inches from the wall, c, and appeared to have been also a place for cooking. *b*, the aperture in the wall c, through which the heat flowed into the flues, *d*, *d*. An aperture, *h*, in the wall *l*, communicated with the flues formed under the mosaic pavement of the room adjacent. The flues were 4 feet deep, and 1 foot 11 inches wide, so that a man could creep along and clean them. At the extremities of the flues, tile funnels, generally having oblong holes in their narrowest sides, were placed upright in the wall to convey the heat upwards. The holes, in adjoining ranges, being placed opposite to

each other, allowed the hot vapour to circulate through the series of tile pipes.

A hypocaust was formed under each of the rooms

FIG. XVI.

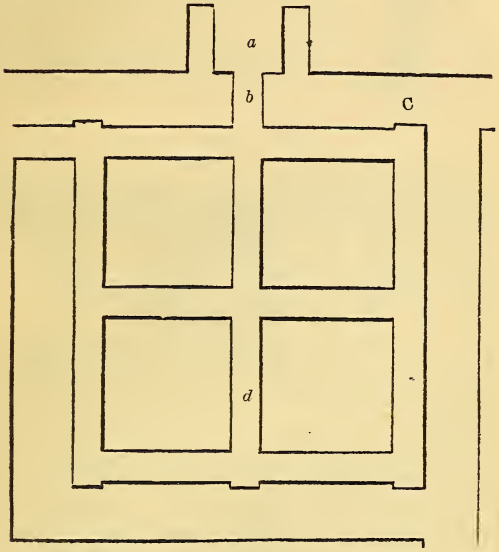
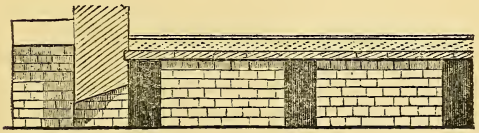


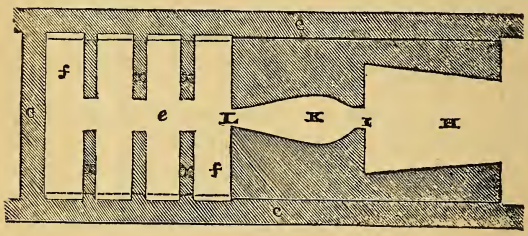
FIG. XVII.



E, I, (Fig. XIII.,) with brick pillars 11½ inches square and 9 inches asunder; and the heat from both appears to have been conveyed into the adjoining apartments.

The figure represents one of the funnels that had two holes in one side, and one hole in the opposite side. They were 7 inches wide, and 5 inches broad, and 15½ inches long. The three lateral holes were about 2 inches square. Some other pipes had holes 4 inches long, and 2 inches wide.

FIG. XVIII.



Fireplaces on the outside of the building formed similar to the fireplace that has been described in the room O, were placed at M and N, R, S, (in the plan of the villa, Figure XIII.,) which heated the flues beneath the apartments near them. Under the galleries, R, S, the flues ran close to the foundations, and had others crossing at right angles.

The situation of the warm air or vapour bath, was at X, in the general plan of the villa, (Fig. XIII.). A ground plan or horizontal section taken a few inches above the floor of the hypocaust, is given in Figure XVIII. H, is the *præfurnium* or porch of the furnace. I, the furnace or fire-chamber. K, the *focus* or hearth on which the fuel was burned. L, the throat or aperture at which it communicated with the *hypocaust* or stove. The furnace was 7 feet long, and 17 inches

in width at its mouth, which increased to 28½ inches at the hearth, and thence diminished to 13 inches at the throat. It had the same height throughout, and its floor was level. The hypocaust was 9 feet 10 inches in length, and 8 feet 10 inches wide. The six piers *x*, *x*, were pyramidal with the narrow end for their base. Figure XIX. is a section of the hypocaust in the line of its width, and Figure XX. a section in the line of its length. The piers were partly

FIG. XIX.

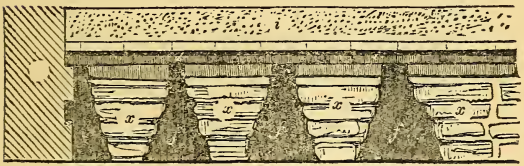
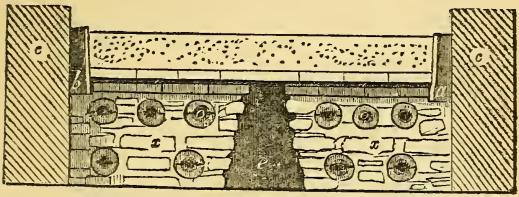


FIG. XX.

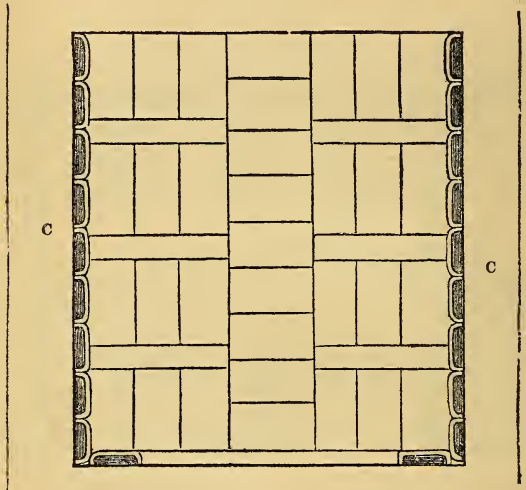


built of unhewn stone, and partly of thin bricks, in a very rough manner, and their wide joints were filled with a reddish sort of clay. They had a number of perforations, *o o*, formed by two curved or ridge tiles laid so as to form a tube, or by a ridge tile laid on a flat tile. They seem to have been formed with the view of allowing the hot vapour to disseminate itself more equally through the hypocaust; no flue was observed for the exit of the smoke. The longitudinal

flue *e* formed by the piers was 21 inches wide at bottom and diminished to 7 inches at top, the 8 spaces, *t t*, were 18 inches wide at bottom, and decreased to 6 inches at the top.

On these piers were placed bricks, *i i*, 2 inches thick, 12 inches wide, and 24 inches long, that formed the ceiling of the hypocaust, and on which was laid

FIG. XXI.



the tiles and cement, *h*, 8 inches thick, that made the floor of the sudatorium, *l*, of which Figure XXI. is a ground plan. C, is the walls of the chamber. A row of curved tiles, that form a series of perpendicular brick funnels extended along two sides of the sudatorium. Their lower ends were open to the hypocaust, (see *a b*, Figure XX.,) and the upper edges of the first row rose about 1½ inch above the floor.

Other rows of funnels were placed on these, and a thick coat of stucco laid on them made the casing smoke bright. They serve the same purpose as the tile lining of the caldarium of the baths at Pompeii.

FIG. XXII.

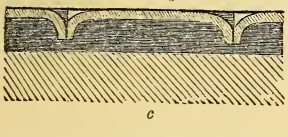


Fig. XXII. is a section on a larger scale of these curved tiles; *w*, the curved tile about 18 inches long and 13 inches wide; *s*, the space in which the smoke from the hypocaust circulates between the tile and the wall, C.

The walls of the villa remained entire for a few inches only above the floor, so that no notion could be formed of the height to which these funnels were carried. But from the large size of the hearth, and the moderate area of the floor of the sudatorium, it is probable that it was not found necessary to carry them as high as the ceiling to acquire the necessary temperature, and they may have terminated at the second or third row.

The sudatory of the villa at Northleigh had the walls lined with *square* brick funnels, which went through the floor into the hypocaust.* They were 18 inches in length, and the internal opening was 4½ inches by 2 inches; the pipes were set perpendicularly on each other, so as to form a close range of upright flues, between which there was a continued lateral communication by means of small corresponding

* Hakewill, in Oxonia Restaurata, p. 12. The square brick funnels found in the hypocaust at Dover were each made of four tiles. They were fixed together with four cramps, and had lateral holes of communication.—Arch. vol. v. p. 327. The ancient bath in the island of Lipari had two rooms lined with vertical square clay tunnels. At Faro Point, Sicily, one of the rooms over the natural warm baths was lined in the same manner; and a hypocaust on an exactly similar construction was found in the remains of some ancient baths in Catania.—Arch. vol. xxiii. p. 100.

apertures on the sides of each funnel. *Behind* these rows of funnels (or caliducts), six other separate ranges of funnels, of the form of those that are shown in Fig. XVIII., with an opening of $4\frac{3}{4}$ inches by 4 inches, were built in the walls. These also communicated with the hypocaust; but it was remarked that they were entirely discoloured by the smoke, while the square tile pipes in front had hardly a tinge of it; from which it was conjectured that their use might be to discharge the smoke at the eaves, but the outer funnels, being closed at top, and having no draught through them, contained the air that communicated its heat to the room.

The villa at Bignor exhibits a peculiarity not elsewhere found in Roman buildings. In using open fires, it is not probable that it was always convenient to place the hearth in the centre of the apartments. Two rooms in this villa had their hearths placed against the wall, and enclosed with jambs like a modern fireplace. One of them was $21\frac{1}{2}$ inches wide in front, 17 inches wide at the back, and 8 inches deep, with a hearth formed of bricks; another room had a similar fireplace, but $19\frac{1}{2}$ inches wide in front. The sloping jambs of these fireplaces were placed as in the stove recommended by Count Rumford. It could not be ascertained whether they had chimneys.*

* Lysons. Arch. vol. xiii. p. 209.
Were the Romans as ignorant of chimneys as the Greeks? (see page 35). Vitruvius does not mention a chimney even to carry off the smoke of a furnace, (see page 41). When the Triumviri caused the proscribed to be sought for by the military, some of them had, says Appian, De Bellis Civil. lib. iv., hid themselves in the chimneys, or rather in the smoky apartments of the upper story under the roof, inhabited only by poor people, as Beckmann explains it. The roofs of kitchens were to be made high and arched, that their timbers might not catch fire.—Columella. De Re Rustica, lib. i. c. 6. This precaution would have been unnecessary, had chimneys been known. Horace describes an accident of this kind when the landlord of an inn was making a large fire to get some birds cooked in a hurry for Mæcenas and his company: Lib. i. sat. 5. He, as well as Juvenal, talks of smoky houses, which shows that people suffered for the want of chimneys. The word *atrium*, or hall, had its rise from the

Similar hearths, it is thought, are alluded to by Palladio, where he says that "The ancients made their chimneys or hearths in the middle of the room, with columns or modiglions that supported the architraves, upon which was placed the pyramid of the chimney whence the smoke issued. One of these hearths was to be seen, in his time, at Baiae, near Nero's piscina, and another near Civitta Vecchia. Where the ancients were not desirous to use chimneys, they built, in the thickness of the walls, some tubes or pipes, through which they conveyed the heat of the fire that was under the rooms, and which came out of certain vents or holes that were made in the top of the pipes.* One of the methods of heating described in the preceding passage, we have seen, was employed

walls of these places being blackened by smoke.—Isidorus, xv. 3. The habitations of people not of the lowest ranks are represented as black with smoke-stains and smoky. Columella speaks of the "*soot* which adheres to the *roof*:" De Re Rustica, lib. i. c. 17; that could only be in apartments without chimneys. Pantries for flesh and wine are to be made near the kitchen or oven, and also coops for fowls, that they may partake of the smoke: De Re Rustica, lib. viii. c. 3.; but articles spoiled by smoke were to be kept at a distance from the kitchen: Columella, l. 6. 20. Quintus Curtius says, that Alexander, in his march to Gabara, encouraging his soldiers, "showed them *smoke* that rose from roofs afar off, advising every one to take the nighest refuge."—Lib. viii. c. 4. Montfaucon says, "from the Latin word *Caminus* is derived *chiminea* of the Spaniards; *camino* of the Italians; *cheminée* of the French; *kamin* of the Germans;" and *chimney* of the English; and with the name was transmitted the invention. Beckmann observes, though the derivation be just, the conclusion is not so. An ancient name has been transferred to a new invention. "Even if we should conclude that the ancients were acquainted with the art of constructing elevated funnels for conveying off smoke, when we consider the many proofs that we have to the contrary, they were, at any rate, extremely rare." —Hist. of Inventions, vol. ii. p. 88. Sir William Gell observes, that chimneys were certainly found in two instances at Pompeii, (see page 46); and that they certainly existed at all times in the South of Italy: Pomp. ii. vol. ii. p. 140; but he quotes no authority for his observation. The point is yet to be explained how the smoke could be conducted from such immense furnaces as those of the hypocausts of the public baths, without the aid of chimneys. Kitchens were sometimes 145 feet long.—Moule on Villas of the Ancients, p. 176. If the fires were large in proportion to the size of the apartment, without a chimney the smoke must often have been uninhabitable.

* Libri dell' Architectura, l. iii.

by the Romans. We know that in the fourteenth century, fires were made in the houses at Rome, (that were then very low and thatched,) on a hearth or in a hole in the middle of the floor, and without a chimney.* The fireplaces seen by Palladio, were not, therefore, mediæval structures, nor vestiges of a mode of heating that had become obsolete only a little while before Alberti and himself introduced elegance and comfort into Italian buildings, and established the use of recessed hearths with smoke flues. Palladio considered them to be ancient, and much authority is due to his great knowledge and judgment of Roman building. On this much litigated question it were not, however, becoming here to decide. The necessity for chimneys, it is true, backed by the remains at Civitta Vecchia, and by the chimney in the Temple of Isis at Pompeii, and by the second row of tiles in the villa at Northleigh, give fair and strong ground for believing that the Romans occasionally conducted smoke from a hearth by pipes in the walls, and also in the manner still seen in some parts of Holland, where the fireplace, made in the middle of the kitchen, has a canopy or pyramid over it that extends to the ridge of the roof for the escape of the smoke. On the other hand, it must be admitted, that the total absence of mention or vestige of the contrivance in ancient writings and buildings, is certainly greatly in favour of the popular opinion, that the Romans were ignorant of a comfort daily enjoyed by the meanest among ourselves.

Hypocausts constructed in the manner of those described, seem to have been used in other northern countries where the Romans established themselves; and the house in which Julian lodged in Paris, was probably warmed by a hot floor and flued walls.

* Muratori. Script. Rerum Ital. vol. xvii. p. 46.

"The winter," says the emperor (in his *Misopogon*), "was then uncommonly severe, and the river was frozen; and being more boorish than usual, I would not suffer my servants to warm the chamber in which I slept, though the cold increased, and grew every day more intense. Lest it should draw the damp out of the walls, I only ordered some lighted brands and a few live coals to be carried in and placed there. These exhaled so much vapour from the walls, that my head being oppressed, I fell asleep, and narrowly escaped suffocation. But being carried into the air, and by the advice of my physicians disgorging the food that I had just swallowed, though I did not disgorge much, I was immediately relieved, so as to pass an easy night, and next day I was again fit for business."

It is not easy to comprehend how the damp that excited Julian's apprehension could be exhaled from a flued wall. His objection, however, shows that some inconvenience was usually produced by that particular kind of apparatus, and which, in all probability, arose from the insensible transpiration of carbonic vapour from the hypocausts, through imperfect joints into the sleeping chambers. Yet it is doubtful from his account, whether the brands that occasioned the accident had been placed in the hypocaust, or whether they had been burned in a brasier in the apartment. In either case, the effect in a close room would have been the same. The danger of the practice did not, however, lead to its discontinuance. Ammianus Marcellinus states that his successor Jovian was accidentally suffocated by the vapour of a charcoal fire that had been lighted to warm his bedroom.

From the preceding examples it will be apparent that the modern method of heating by flues is different from the ancient; with us a large mass of fuel is burned in a capacious furnace, constructed in such manner, that

all the air entering the heating flues must rise at a high temperature from the incandescent fuel; and a great extent of flue is heated by one fire. There is no means of equalizing the heat at different points of the same length of flue, and the parts near the furnace are constantly overheated, while those more remote are comparatively cold. The Roman practice, as exhibited in the villa at Woodchester, is more judicious. Each apartment has its own fireplace, and flue, or hypocaust; and can be warmed, independently of another apartment, to the particular temperature required, without the waste of fuel that takes place when many apartments must be heated when a part only is wanted: by burning the fuel at several points, the danger of accident and destruction of the apparatus, that is occasioned by one great fire, is avoided. The nature of the fuel, and form of the fireplace also, were advantageous. The furnace not being enclosed, the hot gases that rose from the wood were greatly reduced in temperature by mixture with the air, and the hypocaust was filled with vapour at a comparatively low heat. This being spread over a very large surface, and more equally diffused than is practicable in the modern method, the warmth produced in the building was more uniform and genial.

ESSAY IV.

When the Romans landed in Britain, they found the natives of the country differing in their degree of wildness. Nothing could exceed the ferocity of the Britons who inhabited the Wiltshire Downs, nor was anything more disgusting than their filth and poverty. To protect their infants, says Tacitus, from the wild beasts, and inclemency of the weather, they knew no other expedient than to make a kind of cradle amid the branches of trees interwoven together. The youth of the country had the same habitation; and amid trees old men were rocked to rest. They preferred this to the drudgery of the field, to the labour of building, and to the painful vicissitudes of hope and fear, which always attend the acquisition of property. Secure against the passions of men, and fearing nothing from the anger of the gods, they attained that uncommon state of felicity in which no want is felt to excite a single desire. In the northern parts the natives dwelt naked in tents, and slept on skins on the ground, and would continue whole days up to the chin in bogs without food; and the Kentish savages, who were the most humanized, also dispensed with the use of clothes, and went naked with their wives and children to the solemnities. They formed detached huts of stakes and wattles, and thatched them with reeds and straw, or they built them like

those near Chun Castle in Cornwall, of loose stones without mortar, and without chimney or window; or they excavated deep caves like the Germans, and lived in them, surrounded by their provisions for the winter, and stifled with smoke.

Among these wild men, the art of making fires and ventilating their abodes was of small importance. But when they acquired a taste for the decent luxury of clothing, and the influence of neighbouring civilization had drawn them from their trees and pits, they built houses and cottages of wood and stone, and to form convenient fireplaces, they made shallow excavations in the ground, in which they placed a large flat stone for a hearth. Hypocausts also of regular masonry, in the form of a cross, covered with large stones and well cemented with mortar, and numerous fragments of glass,* pottery, and painted stucco, found in the remains of ancient British villages, indi-

* Hoare. Ancient History of South Wiltshire, p. 85.—"From the manner in which Lactantius speaks of the windows, 'vitro aut speculari lapida obductas,' the Roman casements at that period seem to have been furnished with glass as familiarly as with talc, but it was never introduced into the British provinces by the Romans: and the art of manufacturing glass was unknown in the island for two and a half centuries after their departure."—Whit. Hist. of Man. vol. ii. p. 416. Douce also thinks it probable that they did not introduce the use of glass among the Britons.—MS. Note. The numerous fragments of glass found in sites unquestionably British, show that the material was known in the island before the Roman invasion. It has been seen that glass was used in the time of Seneca, and in the windows at Pompeii, and that Pliny enclosed a portico with it; and that it had become a common decoration of apartments 350 years before the Romans abandoned Britain. During all that time, Romans of every rank constantly resided in Britain, and imitated the buildings of their own country: it would not, therefore, be reasonable to infer that these luxurious conquerors adopted the contrivance of hypocausts and flues for heating rooms, and, at the same time, discarded the greatest and most desirable comfort they could enjoy in such a cold, variable, and humid climate as Britain,—warmth, with daylight, and protection from wet and wind, by glazed windows. The Britons, who imitated their buildings, *must* have glazed the apertures in their houses also. It is probable that, in these ages, glass and talc were expensive; but that would only confine their use to the houses of the wealthy. The fragments of common glass found at the stations, or stationary towns of the Roman Britons, was a clear but green tinctured material. That discovered at Pompeii was also clear, and greenish in colour.

cate that the elegancies and comforts of domestic life enjoyed by the Romans, were spread among the hitherto barbarous Fenni of the West of England.*

* "That coals were known to the Britons before the arrival of the Romans, is, says Pennant, highly probable; and also that they made use of them. It is certain that they had a primitive name for the fossil, that of *glo*. And, as a further proof, I may add, that a flint axe (see Phil. Trans. No. 335), the instrument of the aborigines of our island, was discovered stuck in certain veins of coal exposed to day in Craig y parc in Monmouthshire, and in such a situation as to make it very accessible to the inexperienced, who, in early times, were incapable of pursuing veins to any great depth."—Tour in Wales, p. 17. Whitaker concludes that coal, from its proximity to the surface, could not be unknown to the primitive Britons, because the rivulets bring down fragments of coal from their native mountains; and the extremities of the strata often rise into daylight, and little pieces are washed away by the neighbouring waters.—Hist. of Manchester, vol. i. p. 303. Wallis was of the same opinion on other grounds. "In digging up," he says, "some Roman foundations at Caer Voran in Northumberland, a quantity of coal cinders was found *below* them, and some of them very large;" and he infers that they were placed there by the Britons.—Hist. of Northumberland, vol. i. p. 119. Several pieces of coal, "upwards of forty, as large as eggs, and a quantity of slack," were discovered under the Roman way to Ribchester, which it is conjectured were deposited there by the Britons for the use of the garrison. That they were acquainted with coal is further evident "from its appellation among us at present, which is not Saxon but British, and subsists among the Irish in their *o-gual*, and among the Cornish in their *kolan*, to this day."—Ency. Brit. vol. vii. p. 70. It is, however, less doubtful that coal was known to the Brito-Romans. Pieces of fossil coal were found superincumbent on the Roman bath at Wroxeter.—Archæologia, vol. ix. p. 326. Sir R. C. Hoare found some pieces of pit coal in the foundations of a British village in Wiltshire.—Anc. Hist. of South Wilts, p. 85. The cinders Wallis found at Caer Voran might have been placed there by the Romans. Lysons found a considerable quantity of coal ashes at the bottom of a fireplace in which a boiler had been set in the Roman villa at Woodchester.—Roman Ant. at Woodchester, p. 12. Several large pieces of pit coal were found in parts of the Roman villa at Great Whitcombe in Gloucestershire.—Arch. vol. xix. p. 183. But even had the Britons and Romans known that stores of an invaluable inflammable substance were deposited under the surface, they had no inducement to dig into the bowels of the earth for coal as an auxiliary fuel, when wood and turf were spread profusely over its surface.

Turf, from its convenience and abundance, was so generally used, that at length it appropriated the appellation of firing to itself.—Whit. vol. ii. p. 429. It was known to the Chauci, ancient Germans inhabiting the duchies of Bremen, Verden, and some neighbouring districts.—Pliny, Nat. Hist. xvi. c. 1, says, they pressed together with their hands a kind of mossy earth, which they dried by the wind rather than by the sun, and cooked their victuals and warmed their bodies by it. Tacitus relates, that not long after the building of Cologne, a peat morass, so Beckmann reads it, took fire and burned.—Hist. of Inv. vol. i. p. 335. The knowledge of the way of preparing this kind of fuel seems to have been afterwards *lost* in these countries, until about the thirteenth century. In England it was

The methods adopted by the Roman commonalty were necessarily those imitated in the dwellings of the aborigines; and rooms heated by flues and hypocausts, as in the villa at Woodchester, in all probability, were formed in other houses whose owners could afford them.*

Among the Saxons, the houses were arranged somewhat in the Roman manner, with one large room, and several smaller ones around it, mostly one story high. They were so generally constructed of timber, that the term for building was *getymbrian*, to make of wood, and they had plastered walls and thatched roofs.† No chimneys are seen in the representations of Saxon houses;‡ the fire was made against a hob of clay on the earthern floor, in the centre of the large hall or kitchen,§ and the smoke flowed through a hole in the roof, or by the window when it had one. "According to modern notions of convenience, the fire in the middle of the room would be out of its place from being always in the way; but an investigation of the principle will convince us that the chronicler was right, who invoked punishment on the head of those proud lords whose selfish disregard of the enjoyment and

always well known, and used by the Saxons. In the year 850, twelve loads of what has been translated *fossil coal* are mentioned, along with six loads of *earth* or *turf*.—Whit. Hist. Man. vol. i. p. 303.

* Whitaker says, "the chimney is undoubtedly a Roman addition. The round hole in the roof of the British house, such as we still see in the cabins of the Irish and hovels of the Scotch, being elegantly altered into a cupola chimney by the Romans: and the British names for *caminus* or chimney, the Welsh *shimnae*, the Cornish *tshimbla*, the Armoric *shimilan* and *sheminal*, and the Irish *shimilean*, are all, therefore, derived from the Roman language."—Hist. Man. vol. 1, p. 358. "Wherever this author," says Douce in a MS. note on the preceding passage, "finds a Welsh or a Celtic word having the same meaning as a Latin word, he infers the thing expressed was introduced by the Romans; not considering that the Celtic has, at least, the same chance of being original as the Latin." To which may be added, that in the present instance the Roman "cupola chimney" is a nonentity.

† Turner. Hist. Anglo-Saxons, vol. iii. p. 43.

‡ Strutt. Horda. Angl. vol. i. p. 39.

§ Accenso foco in medio calido effecto coenaculo.—Bede, l. i. c. 3.

general comfort of their households, made them remove the cheerful hearth from the middle of the spacious hall, into one of its corners." And certainly the Saxon hearth appears in the most favourable position for diffusing the comfort of its radiant heat to the greatest number of bystanders. The material of which the house was constructed had also to be considered; and when placed in the centre of the kitchen or hall, the hearth was in a situation the freest from occasioning accidents by fire. In Saxon stone buildings, the central hearth was probably retained from custom.

The Anglo-Saxon window was very small in comparison with the size of the apartment. It was called *enthyrl*, literally an "eye hole," and the rooms were so dismally dark that their inmates were obliged to keep lamps and candles burning in them during the day.* This was, perhaps, derived from their imitation of Roman buildings, and continued from the unsettled state of the community. In these times security had to be studied, and buildings even of the most humble class, being constructed more or less with an eye to defence from surprise and petty violence, made small apertures be adopted from prudence; but Strutt imagines they were made so small from the want of skill as well as proper implements for making large plates of glass, small panes being found very troublesome where the windows were large.† From the paucity of openings and their small size, a Saxon village must therefore have much resembled a modern Russian one, described by Dr.

* The windows in British houses were also small. They were called *guinedeus*, literally "seeing holes."—Whitaker. Hist. Man. vol. i. p. 360.

† Horda. Angl. vol. i. p. 38.

Clarke, in which a window is a mark of distinction, and seldom seen; and that the houses in general have only small holes, through which, as you pass along, you see a head stuck as in a pillory."*

These "eye holes" were sometimes closed with linen; and the Saxons, says Holinshed, "also made much use of lattis, and that made either of fine wicker or ryftes of oak in checkerwise; and some of the better sort did make pannels of horne, instead of glass, and fix them in wooden calmes."† From their intercourse with the Romans and Italians, they could not be ignorant of the use of glass as a transparent weather screen; but as it was a foreign production, its high price may have prevented its general use. The stone church, built by Paulinus at York in 627, was windowed with linen cloth and wood lattice. In 678, Abbot Biscop brought glass blowers from Gaul to Northumberland to glaze the windows of his new church and monastery at Wearmouth; and thirty years afterwards, says Malmsbury, when Wilfrid repaired the church built by Paulinus, he washed from the walls the dirt made by the birds that flew in and out, and made their nests in it; and replaced the linen screens with glazed windows.

The exertions of these liberal and patriotic priests failed in naturalizing a taste for glazed windows. The art made no progress, and in a period when ornament and expense were lavished on ecclesiastical buildings, the apertures of stately stone churches were filled with linen cloth, and wooden shutters.

* Turner. Hist. Ang.-Sax. vol. iii. p. 436. Ray furnishes another illustration of the *enthyrl* drawn from a branch of the Saxon stock. "It is a custom (1661) of the Scots to make up the fronts of their houses even in their principal towns with fir boards nailed one over another, in which are often made many round *holes* or windows for to put out their *heads*."—Itinerary, p. 189.

† Description of England, p. 17.

There is reason for the opinion also that the use of glass was latterly confined to the northern division of England. The material is noticed by Bede as common in Northumberland for several purposes; but two centuries afterwards, Asser, apparently ignorant of the material, applauds the ingenuity of his scholar and patron, King Alfred, in shaving white cow horns into thin plates, and thus making them as transparent as a glass cup; he formed a lantern of wood, with horn panes, to protect his time measuring candles from wind that rushed through the windows and doors, and chinks in the walls, and made them burn with undue celerity.*

The carpenters and masons were not in those times exact workmen, and in houses of persons of distinction the wind from crevices was endeavoured to be kept out by hanging the walls with tapestry.† But their substantial and convenient dress—long coats with sleeves to the wrists, shoes, trousers, caps, and cloaks sometimes lined with furs—was well calculated to make amends for the indoor privation that all classes must have suffered in cold and windy weather. They made great use of leather in their clothing,‡—a

* The hearth was the oven. When Alfred was in the cottage at Athelney, the swaine's wife, as a Latin MS. gives it, "placed, as necessity required, a few loaves, which some call *loudas*, on a pan, with a fire underneath, to be baked." Matthew of Westminster writes, that "the peasant's wife placed her bread *under* the ashes of the fire to bake."—Turner. Hist. Ang.-Sax. vol. i. p. 509. In farm-houses in Norfolk, and other parts, where wood is burned, the hearth is swept; and the piece of dough is placed on the hot stone, and covered with an iron pan, round and above which the burning embers are carefully raked. In the North of England, and throughout Scotland, the oaten cakes are baked, like the *loudas*, on an iron "*gridle*" placed over the fire.

† Turner. Hist. Ang.-Sax. vol. iii. p. 53.

‡ They used *leather saucepans*. A Saxon shoemaker is made to say: "None of you can winter without my craft. I buy hides and prepare them by my art. I make ankle-leathers, shoes, leather hose, bottles, thongs, trappings, flasks, *boiling vessels*, neck-pieces, halters, wallets, and pouches. Domesday Book, in loco."—Turner. Hist. Ang.-Sax. vol. iii. p. 109.

taste still prevalent in many rural districts, and seen lingering in the short buckskin knee breeches put on the infants clothed by some charitable institutions. Their bedsteads, like ours, had curtains; and, although the beds and pillows were of straw, they were soft, and had sheets, blankets, and warm coverlets that sometimes were made of bearskin or goatskin. Their nocturnal climate was, therefore, comfortable, and they enjoyed it; for one of the heaviest penances that could be inflicted, was to debar the offender from the use of the warm bath, and a soft bed. The small eye-hole windows, the want of chimneys, and inattention to ventilation, will account for the high value the Anglo-Saxons put on perfumes, and the profuse use they made of them.*

The hearth occupied the same place in the British as in the Anglo-Saxon houses. Families, says Gyraldus Cambrensis, inhabit a large hut or house, which, having a fire in the midst, serves to warm them by day, and to sleep round by night; and he describes the bands of young men who followed no profession but arms, visiting families to whom they were always welcome, and passing the day with the most animated cheerfulness. At length sunk into repose on a thin covering of dried reeds, spread round the great fire placed in the middle, they laid down promiscuously, covered only by a coarse made cloth called *brychan*, and kept one another warm by lying close together; and when one side lost its genial heat, they turned about, and gave the chilly side to the fire. The great men endeavoured to improve on this custom during the day. A Welsh prince had an officer in his court called a foot-bearer, whose duty it was, at mealtimes, when his master was seated at table, to sit with his

* In the South of Scotland, at this period, the monks clothed themselves in the skins of wild beasts.—Chalmers. Caledonia, vol. i. p. 309.

back to the fire, and keep the princely feet warm and comfortable by cherishing them in his bosom.*

In the magnificent strongholds, built near the time of the Conquest, a central hearth is seldom found. Having several stories in height, and their roofs being used as a terrace for defence, an exit in the common form for the smoke, even from the uppermost chambers, would have been impracticable. In the great guard room of Connisborough Castle, erected in or near the Anglo-Saxon period, is a large fire-hearth, that strikes the eye at first sight, and as the dawn of improvement raises astonishment, says King, in the mind of every beholder. The mantel of this fireplace is supported, like the door of entrance, by a wide arch, not trusted to as sufficient, but having two transom stones running under it, and at a little distance the aperture resembles a modern ornamented chimney-piece; and a ground plan of the room made on the line of the soffet of the mantel shows a recess for the hearth on the common construction; yet, in reality, the back of the fireplace, where it joins the hearth, is on a line with the walls of the room, and the recess at the mantel is formed by the back of the fireplace sloping outwards as it rises into the thickness of the wall, until it reaches a loophole on the outside that forms the place of exit for the smoke.†

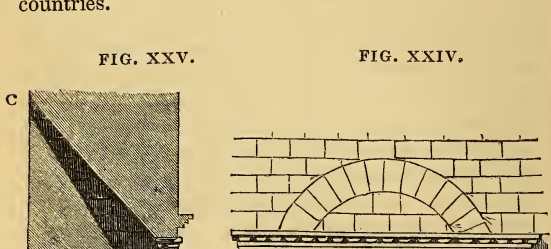
Figure XXIV. is an elevation of this fireplace, and Figure XXV. a section, in which *a* is the floor of the room, *c* the mantel, and *e* the loophole. It is drawn at about half its actual height above the hearth, which makes the back of the fireplace appear to slope too rapidly.‡

In building this hearth, the intention seems to have

* Malcom. Cust. of London, p. 52.
† Munimenta Antiqua, vol. iii. p. 57, vol. iv. p. 244.
‡ Carter. Ancient Architecture, p. 23. Britton (Arch. Antiq. vol. iv.) gives a view of these chimneys.

been not to weaken the wall at the back of the fire-place; and the builder, therefore, made the hearth wholly within the chamber; by doing so he placed it in the best possible position for throwing the greatest quantity of radiant heat into the chamber. This room derived its light solely through a hole in its ceiling that opened into the state room above; and when it was inhabited, its atmosphere could have been equalled in impurity only by the air of the room into which it flowed. The existence of such places, with all the benefit they could derive from hearth openings, would alone account for the virulence of some diseases that in those ages devastated whole countries.

FIG. XXV. FIG. XXIV.

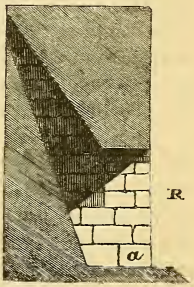


In the castle at Rochester, a tunnel about 2 feet 10 inches in diameter, is carried up in the internal wall, and communicates with the apartments in the tower.* Its use is still an object of inquiry. It may have been an air-tube to ventilate the rooms in the event of being forced to close up the external openings during a siege.

* Archæologia, vol. iv. p. 386.

In other castles erected about the same time, the hearth is generally found removed to the side of the room; but instead of being placed against the wall, it is invariably formed in its thickness, as in the castles at Rochester, Norwich, and Colchester, and the conical smoke tunnel ends in a loophole, as at Connisborough Castle. Figure XXVI. is a section of one of these fireplaces, in which *a* is the hearth, and *c* the loophole. In Colchester and other castles, in order to keep the walls of an uniform thickness, a buttress or projection appears at the back of each chimney, and the flue from the hearth below, from where it rises to the level of the flue in the room over, is carried up along with it to the range of loopholes, from one of which the smoke is emitted. Two flues on the east side, and two on the west side, thus joined together, are yet remaining.*

FIG. XXVI.



In Hedingham Castle "the hearth was formed by a handsome arched cavity between the windows, and carried up through the wall like the Saxons,"† says Strutt. But this was also practised by the Normans; for in the old palace at Caen, inhabited by the Conqueror, while he was yet Duke of Normandy, the great guard-chamber has two spacious recessed fire-hearths in its north wall, still in good preservation, from which the smoke is carried away in the same manner as from the hearths in the castles at Colchester and Rochester.‡

* Archæologia, vol. iv. p. 386.
† Horda. Ang. vol. i. p. 90.
‡ Ducarel. Anglo-Norman Ant. p. 59.

That hearths with smoke-ducts similar to those that have been described, were formed in other stone buildings, is probable from a survey of Clarendon Palace, made by the Sheriff of Wilts in 1272. In this, it is said, "the chamber with the chimney (*camera cum camino*) is in a ruinous condition, and almost unroofed, and therefore requires the greatest repairs." No other room with a chimney being, as Sir T. Phillips observes, mentioned in the palace, are we to infer that this was the only apartment in the building distinguished by a chimney? or was this one only particularized from its being in a ruinous condition? The latter surmise is, however, unlikely —for had there been more than one, the phrase *camera cum camino* would have designated any one possessing that convenience. Winwall House, in Norfolk, described as the most ancient and perfect specimen of Norman domestic architecture in the kingdom,* has not only recessed hearths, but flues rising from them, carried up in the external and internal walls, in the manner that would be followed by the most skilful builder of the present time. A careful inspection of these walls, with a view to ascertain the identity of the hearths and flues with the original construction of the building, would be a most acceptable service to the inquirer into English antiquities.

The miseries endured by the inmates of these pestiferous abodes are, sometimes, extenuated by the observation that all comfort is relative, and that individuals living in a highly cultivated community, bewildered with a multitude of inventions for fostering an unmanly delicacy, are not qualified to form a proper notion of the enjoyments or privations of a semi-

* Britton. Arch. Antiquities, vol. v. p. 212. Castle Rising, Norfolk, has a small room with a fireplace and chimney built before 1176 by William de Albini, first Earl of Sussex.—Ibid, vol. iv. p. 162.

barbarous population, like that of the Anglo-Normans. In the main this may be true; and, at the same time, it may be conceded that some comforts—that of pure air, for instance—are of a nature to be estimated as correctly, and to be as earnestly desired, by the barbarian as by the most fastidious townsman. In Anglo-Norman times, the occupations and amusements of all classes were followed mostly in the open air; and the general tastes of the people being strongly biassed by their pursuit of country contentments, these must have fostered a keen relish of the pleasures of a breezy sky, and assuredly taught them a knowledge of the enervating effects of stagnant air on the feelings and health, which makes the want, every where apparent, of all care to breathe in their houses and streets the same pure elemental fluid they inhaled in their fields, the more remarkable.

In these ages, when dirt is seen every where triumphant, the air of Paris may be taken as a fair average specimen of the atmosphere pervading most other continental towns at the conclusion of the twelfth century. Rigord, the physician to Philip Augustus, relates that one day, as the king, who, according to custom, was walking to and fro in his audience chamber, went to look out on the river for recreation, some carriages belonging to the citizens happened to pass at the moment under the window where the king was placing himself, when the substance forming the street, being stirred up by the revolution of the wheels, emitted a stench so intolerable as to overpower Philip.*

Urged by this disgust, the king exerted himself to persuade the citizens to pave their streets with stone; and to perfect still further the work of purification, and prevent the future desecration of the cathedral,

* De Gestis Philipi Augusti, p. 16.

through its remaining a common corner of convenience, his piety, and zeal for decency, incited him to surround the sacred edifice with a wall; by which means, his biographer observes, he so improved his capital, that from being called Lutetia, (*lutea à luti fœtore,*) on account of its dirtiness, it was henceforth named Paris, after the beautiful son of King Priam.

These patriotic endeavours to preserve public health by sweetening the air of the streets, were not submitted to without murmurings; and, when some of his less popular successors in the kingly office tried to extend into other quarters of the city the improvements begun by Philip, their attempts were viewed as acts of rigour and oppression, tending to sacrifice the privileges and enjoyments of the poor to the squeamish feelings and effeminacy of the rich. The local historians record many instances of inveterate public insensibility to pollution, even after the way was shown how to enjoy the blessing of viatic purity; and they also show that stringent municipal laws were found necessary to enforce the observance of regulations for preventing offensive and noxious accumulations in the streets; and that as often as the hand of strong authority was relaxed, as often did communities become prone to wallow in all the beastlinesses of atmospheric putridity. From this reproach, English towns are not to be excepted; callousness to discomfort and to the public decencies prevailed from one end of the country to the other.

The Anglo-Norman period was nevertheless marked by some improvement. Ecclesiastical buildings, and the castles and houses of the barons and greater landholders, were capacious and magnificent, according to the taste of the period, and no cost was spared in their construction and decoration. Small regard was, however, paid to the habitations of the commonalty, which in London, the mother city of the kingdom,

were, Stowe says, not more than sixteen feet high, poorly built of wood, and ill covered in with reeds and straw, with a hearth in the middle of the floor, and a smoke hole in the roof over it.

Carpets were unknown, except as bedclothes or table covers; and spreading straw and leaves on the floors formed part of the rough magnificence of the times. The practice was general. Pegge thinks it was adopted for coolness; and Nichols, with reason, adds for warmth also.* In the winter season the feet could be covered with the straw, and they required protection at all times from the cold damp floors of bare earth and stone in the hall and kitchen. The beds of the meaner sort were spread on the litter, and in great houses it served the purpose of a chair. Thomas à Becket, when Chancellor to Henry II., according to Fitzstephen, was "manful in his household, and had his hall strewed every day in the winter with fresh straw or hay, and in the summer with rushes and green leaves fresh gathered; for which the whimsical reason is given, that such knights as the benches could not contain, might not dirty their fine clothes when they sat on the floor."† From the special notice of its daily renewal, it may be inferred that this salutary piece of extravagance was not generally followed; and also, that if a gentleman in his best raiment did not compromise his personal dignity by squatting on the litter, it was not an uncommon posture to be assumed in all houses by persons in the lower conditions of society.‡

* Illustrations of Manners and Expenses of Ancient Times, p. 12.

† Brand. Popular Antiq. vol. i. p. 241.

‡ Rushes were spread in churches as a protection from the bad effects of their damp earthen floors. From the humidity of the ground, and trampling of the feet, it was necessary at intervals to clear away the old covering, and replace it with fresh rushes. This custom, which necessity and prudence suggested, was converted into a festival. The annual renewal of the rushes was attended with

In a collection of low wooden houses with straw thatched roofs, having holes through which smoke rose from wood fires burning on a hearth in the middle of the floors, that were spread with straw, it is not surprising that dismal fires were of frequent occurrence, and that conflagrations should consume entire towns. From the contiguity and construction of the houses, accidental fires had been such cruel scourges of the Londoners, that, under Richard I., a law was passed, that in future all houses in the city should be built to a certain height of stone and covered with slate and burned tiles;* and after the fire that destroyed the greater part of Oxford in 1190, the burghers, following the example of the Londoners, also began to construct their houses of stone; and in those quarters where the poor people were unable to be at the expense of this improvement, a high stone wall was raised between every four or more houses.†

rejoicings and ceremonies, and was marked in the calendar as a holiday. Where the floor was improved by a pavement, the rush covering was still found to be more agreeable to the feet than the bare stone, and the ceremonial was continued; but when the rushes were woven into mats, the annual holiday was no longer observed; or if it were, it was only as a respectful reminiscence of an ancient usage. Rush bearing is not yet extinct. The floor of Ambleside Church in Westmoreland is annually strewed, with all the ancient ceremonial honours. Illustrations of Westmoreland, p. 39.

Throughout Sweden and Norway, the floors of the houses are strewed once a week with the green tops of the fir and juniper. On the white well-scoured deal floor the lively green specks have a pretty effect. They serve the same purpose as the yellow sand which our housewives use on floors to prevent the mud on shoes adhering to the wood and soiling it. Gathering and selling these green juniper buds forms a sort of trade for poor people. Laing. Trav. in Norway, p. 83.

* Stow. Survey of London, p. 73, ed. Thoms.

The dwellings of the Scots were either very mean or extremely inconvenient. The bishop, noble, and king, lived in small stone castles, perched on some precipitous rock, with massive walls enclosing narrow stifled apartments, that had no chimneys, and loop-holes for windows. The cottages were slight erections of wood, without hearth, chimney, or window, and their towns were a collection of such hovels. The use of wood in building had been so general that castles were built with it. Several of these combustible strongholds, belonging to the Celtic chiefs in Moray, were burned in the rebellion of Gilliescop.—Chalmers's Caledonia, vol. i. p. 805.

† A'Wood. Hist. of Oxford, vol. i. p. 172.

We have seen that coal in all probability was known to the Saxons and their predecessors settled in some of the coal districts, but more as an object of curiosity than as a mineral forming the staple fuel of any part of the country. In other parts of Europe it was unknown: but it had been long used as a common fuel in China at this period. Marco Polo, a Venetian, who travelled into eastern parts near this time, says, that throughout the province of Kataia there is found a kind of black stone, which they dig out of the mountains, where it runs in veins. When lighted it burns like charcoal, and retains the fire much better than wood, insomuch that it may be preserved during the night, and in the morning will be found still burning. These stones do not flame excepting a little when first lighted, but during their ignition give out a considerable degree of heat. It is true, he continues, there is no scarcity of wood in China, but the multitude of inhabitants is so immense, and their stoves and baths, which they are continually heating, are so numerous, that they could not supply the demand; the stock of wood must soon prove inadequate to such consumption, whereas these stones may be had in the greatest abundance and at a cheap rate.*

* Marsden's Marco Polo, p. 374. Polo says that at Ormus, "the heat that reigns is extreme, that in every house they are provided with *ventilators*, by means of which they introduce air to the different floors and to every apartment at pleasure."—Ibid. p. 737. Marsden in a note on this passage observes, they have a similar contrivance at Bagdad, where they form a subterranean chamber from which they carry a flue or pipe into the apartment to be cooled. The pipes or ventilators used at Tatta in Sind, were described by Major Rennel to be pipes or tubes fixed in the walls and open to somewhat cooler air, answering the same purpose as windsails in ships.—Ibid. p. 740. Polo also observes, that "in the palace of the Great Khan, at Kanbalu, the glazing of the windows is so well wrought and so delicate, as to have the transparency of crystal."—Ibid. p. 289. "There is no reason," says the translator, "to suppose glass was used in China at this period. The meaning may be that the pellucid substance, perhaps talc, or laminæ of shells, was so delicately wrought as to have nearly the transparency of crystal." The manufacture of this material in

About the end of the twelfth century a notice of coal first appears as an article of traffic, and as a staple element in the social comfort of our own country. In the Leges Burgorum, enacted at Newcastle about 1140, the especial privilege of not being distrained but for their own debts, is granted in Scotland to the inbringers of fuel, which is described to be "wood, turves, and peits."* With respect to coal there is a complete silence,† from which it has been somewhat hastily concluded, that though coal must have been known, it was not used as fuel. The first legal notice we have of this mineral is in a grant, made in the reign of William the Lion, by William de Vetereponte, to the monks of Holyrood, of a "tenth of his coal at Cariden;" and in the Chartulary of Newbottle, there is a grant in 1189 to the monks by De Quincy, Constable of Scotland, of the coal between Whiteside and Pinkie, which is also confirmed by King William.‡

In 1239, Henry III. granted a charter to the inhabitants of Newcastle to dig for coal, which is the first legal mention of the fuel in England. Its properties and value must, however, have been long known in this locality, before the privilege to dig for it was thought worth a payment of 100 pounds a year. The use of the mineral seems to have rapidly increased; for in 1281, Newcastle is said to have had

some eastern countries in very ancient times, and the fact being stated by the Chinese writers that it was used in China ages before the date of Polo's travels, almost render Marsden's opinion untenable.

* About 1215, according to the Dutch Chronicles, the manner of preparing, and use of turf, were introduced into Holland. About 1221 it was an article of traffic, by which some acquired great riches.—Beckman. Hist. Inv. vol. i. p. 336. It was unknown as a fuel in some neighbouring countries for four hundred years after this period.

† Arnot. Hist. of Edinburgh, p. 84.

‡ Chalmers. Caledonia, vol. ii. p. 866. Arnot, to whom these grants were unknown, says, the first mention of coal in any charter in Scotland is in a grant, made in 1291 to the convent of Dunfermline, of the privilege of digging for coal in the lands of Pittencrief.—Hist. Edin. p. 84.

a considerable trade in it; and about the conclusion of the century, coal was imported into London for the use of brewers, dyers, smiths, and others.* So strong, however, was the prejudice of the citizens against its use, from an opinion that its fumes corrupted the air, and were most injurious to health, that in 1306, parliament petitioned the king to prohibit burning the noxious fuel in the city. The royal proclamation having failed to abate the growing nuisance, a commission was issued to ascertain who burned sea coal within the city, and in its neighbourhood, and to punish them by fine for the first offence, and by demolition of their furnaces, if they persisted in transgression; and more vigorous measures had to be resorted to. A law was passed making it a capital offence to burn sea coal within the city, and only permitting it to be used in forges in the neighbourhood. Among the records in the Tower, Mr. Astle found a document, importing that in the time of Edward I. a man had been tried, convicted, and executed for the crime of burning sea coal in London.† Yet it is difficult to reconcile this extreme rigour with a claim made to parliament, for a sum of ten shillings, for pit coals that had been ordered, but not paid for, by the clerk of the palace, and that were burned at the king's coronation, that took place a few years afterwards. Shortly after this, coal was exported; and in 1325, a vessel, the property of Thomas Rente, of Pontoise, (a town at that time belonging to England,) trading to Newcastle, returned with a cargo of pit coal.‡ It is probable that, at this time, it was a marketable article in the place of importation. In all likelihood the trade

* Barrington. Observations on some Ancient Statutes, p. 15.
† Blane. Med. Diss. p. 127.
‡ Brand. Hist. of Newcastle, vol. ii. p. 255.

had greatly increased, for in 1327 the measure of coal became an object of municipal regulation; in Scotland, also, its use was gaining ground; in 1329, a chaldron of coals appears charged to the Scots Parliament.* It had become a common article of traffic, when Sir William Douglas and Sir Simon Fraser, a few years afterwards, surprised the English garrison in Edinburgh Castle. He and his party, according to the chronicler, went to sea, and purchased oats, oatmeal, *coal*, and straw, and landed at a port about three miles from the stronghold; they loaded twelve horses with these articles, and disguising themselves "in old threadbare clothes, with torn hats like poor tradesmen," they proceeded to the castle and offered their merchandise for sale. When admitted by the porter within the first gate, they flung off the loads of two horses, which consisted of coal, directly upon the sill of the gate, so that it could not be shut, and then seizing the porter, whom they murdered instantly, and placing the remainder of the coal also within the gates, so that they could not be closed, the dire coal merchants introduced their companions within the castle.†

Wood and turf and peat were the staple fuel of the country. The prejudice against sea-coal as an insalubrious firing was exhibited even in the coal fields. In 1349, in the religious house at Whalley, peat, with a very little wood, was the fuel used; no coal was burned, although the mineral abounded in the neighbourhood.‡

To burn wood, the fireplace was furnished with an andiron, which was a bar of iron stretching across

* Arnot. Hist. of Edinburgh, p. 92.

† Froissart, vol. i. p. 223, edit. Johnes.

‡ Whitaker. Whalley, vol. i. p. 61. In this house wood must also have been generally used for light; for there was a very scanty provision of oil for lamps, and of tallow almost none. About 1298, tallow candles began to be used instead of splinters and flambeaux.

the hearth, about six or eight inches above it, and supported at each extremity by feet or standards, giving to the implement the form of a low trestle. It was used to raise the ends of the pieces of wood that were burning. An early mention of this article of ancient household furniture is found in an assessment of a fifteenth of the moveables, made at Colchester in 1290, where, among other things, the andirons of Roger the dyer are valued at two shillings.* In the wardrobe accounts of Edward I., about 1300, an allowance is made to Thomas le Convers for repairing the andirons (*aunder ferr,*) of the king's chamber.†

In all times, love has been described as a fire, and many things noted as fuel that will keep it burning; but the object of "The Fraternity of the Penitents of Love" was to show, that the fire of *their* love could in winter produce on them the same effect as a fire of wood and charcoal; and in the dog days act like ice and snow. To prove this, the resolute knights and squires, dames and damsels, who had the hardihood to embrace this severe institution, clothed themselves during the heat of summer in the thickest mantles, lined with the warmest furs; the fire of their love kept them cool as the icicle that hangs on Dian's temple. In the winter season they dressed themselves in the thinnest and lightest stuffs that could be procured. It was a crime to wear fur on a day of the most piercing cold, or to appear with a hood, cloak, gloves, or muff. The flame of their love kept them sufficiently warm. Fires all the winter were banished from their houses. They dressed their apartments with evergreens; and in the most intense frosts, their beds were covered only with a piece of canvass. The fire of their love made every thing genial. The devotees

* Morant. Antiq. of Colchester, p. 46.
† Gentleman's Magazine, 1787, p. 409.

passed the greater part of the day abroad, wandering from castle to castle; and during their desperate pilgrimage, many of them perished by the inclemency of the weather, and died martyrs to their enthusiastic profession.*

It has been observed that the practice of strewing the floors was universal; and it seems to have extended into the apartments of the kings themselves. William, son of William of Aylesbury, held lands from Edward I. on condition of providing straw for strewing the king's chamber in winter, and herbs in summer.

Glass windows, that in the time of William the Red were a mark of great luxury and magnificence, when placed in a church or palace, begin now to be seen in the houses of persons who affected indulgences, and knew how to enjoy them. Chaucer, who from his tastes and propensities may be considered one of the "perfect gentlemen" of his time, says in his Dreme, that in his bed-room,

"with glas
Were all the windowes well yglazed;"

and kept in such good order as to be

"Full clere, with nat an hole ycrased;"

and moreover so beautifully painted,

"That to behold it was great joy;
For holly all the story of Troy
Was in the glaising ywrought."

It may also be noticed that the windows were

* Warton. History English Poetry, vol. ii. p. 219. Edit. 1840.

moveable; for he further tells us that when he was reposing, the

"Windowes weren shut echone,
And through the glas the sunne shone"*

upon his bed. The manner of hanging and fastening these windows is described by a cotemporary romancer. When the Squyr of Lowe Degre poured out the sorrows of his disconsolate love for the king of Bohemia's daughter,

"That lady herde his mournynge all
Ryght under the chambre wall;
In her oryall there she was,
Closed well with royall glas,
Fulfylled it was with ymagery.
Every wyndowe by and by,
On eche syde had there *a gynne*
Sperde with many a dyvers pynne.
Anone that lady fayre and fre
Undyd a pynne of yveré,
And wyd the wyndowes she open set
The sunne shone in at her closet;" †

from which it is clear that the window she opened was framed and fastened like the casement in a modern cottage.

Returning to the poet's bed-room for a few illustrations, it is found that as well as the windows,

"All the wals with colours fine
Were paint both text and glose;"

which shows that the wall must have been plastered

* Works, fol. 229. Edit. 1602.
† Ritson. Metrical Romances, vol. iii. p. 149.

with some care before it could receive a painting, rough as it might be, and, therefore, without the chinks that let the wind into the Saxon palaces. Arras or tapestry was also hung on walls, of which that ornamenting the hall in Warwick Castle in 1344 was a superb specimen. It should, however, be borne in mind that it was most likely seen only in regal palaces, or in houses rivalling palaces in their furniture and in the presumption of the owner.

In these times feather beds were not uncommon among persons of condition, and were reckoned so great a luxury, that to be debarred sleeping on one, if the sinner had it, was, as in former times, deemed a severe penance for the heaviest transgression. Chaucer speaks of beds and pillows, even

"Of *downe* of pure dove's white;"

and that they had the properties most desired in that essential part of bed-room apparatus will appear from what he compares them with:—

"Sprang up the grasse as thick isett
And soft eke as any velvett,
On which man might his leman lay,
And softe as fether bedd to pley."

Other paraphernalia of the chamber of repose are described in the Squyr of Lowe Degre, in which the lady is promised

"Your blankettes shall be of fustyane,
Your shetes shall be of clothe of rayne,
Your hedd shetes shal be of pery pyght,
With dyamonds set and rubyes bryght."*

* Ritson. Met. Rom. vol. iii. p. 180.

Amidst all this laudable attention to warmth in nocturnal climate, no mention whatever has been made of any means of heating the dormitory; and there does not seem to have been any except a pan of charcoal.

A notion may now be had of the comfort enjoyed in the houses of persons of rank. The spacious lofty hall, left open to the roof, had its windows placed high from the floor, and filled with oiled linen or louver boards, or occasionally with painted glass. Its clumsy unframed doors were opened by latches; and when the walls were not coarsely painted in the fashion of the time, they were left rough, and covered with arras suspended by hooks at a distance of 3 or 4 inches from the wall. The floor of stone or earth had a part at one end raised a little above the general level, and laid with planks. On this platform or dais stood a massive table and ponderous benches or forms, and a high backed seat for the master under a canopy. On the hearth, in the middle of the hall, were placed the andirons for supporting the ends of the brands, that were arranged by means of a heavy two-pronged fork, the type and predecessor of the modern poker.

On the roof over the hearth was a turret or louver, filled with boards arranged so as to exclude rain and wind, and permit the escape of smoke; and this was sometimes an object of considerable architectural beauty in the external aspect of the building.

In this gaunt and aguish apartment, heated by a single fire, the company were in a position not much different from what they would be in the open air; not a particle of heated air could add to their comfort, for as fast as produced it escaped through the louver: light was the only solace the greater number could derive from the blazing fuel; and the few who were in a situation to feel the radiant heat, were incommoded by the current of cold air sweeping

like a hurricane along the floor towards the fire. From the height of the louver and low temperature of the smoke, few of the buoyant flakes of charcoal found their way into the atmosphere, and the larger the bonfire, the thicker was the layer of soot deposited on each individual. Boisterous weather also brought its annoyance. Had the fire been made in an open field, they might have moved to the windward of the smoke, but in the hall where could they flee to from its miseries ?*

The chamber, like the hall, was lofty, and lighted with tall narrow windows filled with oiled linen or glass, with a part made to open like a casement, and screened with a curtain; it had neither a hearth nor a flue. The massy and elaborately carved bedstead was furnished with silk velvet or arras hangings of the most substantial description, as were also the blankets and sheets; the bed and pillows were stuffed with feathers, and laid on the straw spread on the bed laths. The floor was covered with rushes; and a heavy oak stool, a chair with a cushion, and a huge chest for a wardrobe, completed the bedroom apparatus among the upper classes.

* Arnot, quoting from Froissart, draws a very unfavourable picture of his countrymen in the fourteenth century. They were, he says, like wild and savage people. Edinburgh at that time, although the first city in Scotland, could not lodge the French soldiers, many of whom were obliged to live at Dunfermline, and other towns at a still greater distance. The French knights complained bitterly of their wretched accommodation—no comfortable houses, like those they had left in their own country—no soft beds—no walls hung with tapestry, or any other conveniences. In camp they had no beds, pots, nor kettles, nor wine, and they boiled the flesh of the animal in its own hide; and it required all the prudence of the French commander to restrain their impatience to leave what to them seemed so miserable a country. Hist. of Edin. p. 54. And from another chronicler we learn that "ere they did put their shoes on, especially in the sharpest weather in winter, they dipped them in water. They were substantially, but sparingly clad, and slept on the bare floor on pallets of straw. They broke their faste early in the morning with some slender repast, and so continued without any other diet, until supper time, in which they had but one dish, whereby it came to passe, their stomackes were never over charged, nor their bones desirous of rest thorow the fulness of their bellies."—Holinshed. Description of Scotland, p. 18.

Fumigation was the only means used to sweeten these close and musty enclosures. In the romance of the Squyr of Lowe Degre, a lady is promised that she will be brought to her chamber with great rejoicings, and when she is

"Layde in bedde so softe,
A cage of golde shal hange alofte,
With long peper fayre burnning,
And cloves that be swete smellyng,
Frankensence and olibanum."*

The country houses of inferior landholders and farmers were generally one story high. If they were built with two stories, the roof was so deep as to reach to the ceiling of the lower room. The hall and kitchen forming one apartment, and roughly plastered, was open to the timbers of the roof, and sometimes had a louver, and a window that could be closed with a shutter.

"Barre we the gates,
Cheke we and cheyne we and eche chinc stoppe
That no light leopen yn at lover ne at loupe."

When these houses had a room to sleep in, old and young reposed in the same apartment, and several in one bed; servants made their beds on the floor in the kitchen.

Cottages had neither louver nor loupe, and their inmates lay round the fire. Longlande describes one of a vagrant group—

"Suten at even by the hote coles
Unlouk his legges abrod other lygge at hus ese,

* Ritson. Met. Rom. vol. iii. p. 180.

Rest hym and roste hym and his ryg turn,
Drynke drue and deepe and draw hym than to bedde."

In lodging houses the same packing system was followed, and when a person had a bed to himself, it was a mark of distinction, and recorded accordingly. The red haired, curly headed, girl-kissing-priest that was

"Cleped hendy Nicholas,
A chambre had he in that hostelrie,
Alone withouten any compagnie,
Ful fetishly ydight with herbes sote.
And he himself was swete as is the rote
Of licoris or any setewale."*

In ventilating these rooms by fumigations, the place of the "cage of golde," and cloves and frankincense, was supplied by a brazen chafingdish or perfuming pan, with a bit of rosin or a fir cone placed on the embers, and where the taint was not very strong, and the inmate fastidious, some fresh gathered herbs strewed on the floor, as in hendy Nicholas's bed-room, was a common process of purification.†

* Warton. Hist. of Engl. Poetry, vol. ii. p. 191. Licorice is now appropriated to the cure of sore throats, and setewale or valerian is abandoned to old women to wear in their pockets, as a charm to entice cats who are fond of the odour near them. It is clear, however, that Nicholas knew what the miller's wife was pleased with, for his rival, the "joly lover Absalon," the parish clerk, as soon as he rose in the morning, began to chew grains of paradise and liquorice as a perfume to make himself agreeable to his handsome mistress.

† In these times the ventilation of towns was, if possible, more defective than that of houses, and must have greatly aggravated the domestic nuisances. Oxford may be taken as being a well authenticated example. In 1300, the University complained to Edward I. that the great store of filth lying in the streets corrupted the air, and destroyed the health of the scholars. In the king's breve, the townspeople are ordered to repair and mend the floor or pavement of the town, in every street and lane, to remove all filth lying in them; also, the *hogs* which did increase it; and the sheriff was to cause the burghers to do the like before their doors. Six

The fragrant materials they employed to perfume themselves, would to a modern fair dame have made their persons feel as sickly and unpleasant as their bed-room.

The spread of luxury prepares us for another innovation on the ancient simplicity of manners by the custom now introduced among the great, of retiring from the wearisome pomp of the hall, and the observation of dependents, to the ease and comfort of a private parlour, leaving the dais to be occupied only on occasions of ceremony. Longlande, in Pierce the Plowman's Vision, feelingly alludes to the change as prompted by a mean and selfish wish to abridge the ancient hospitality observed towards the poor.

"Elynge is that halle eche day in the wyke,
Ther the lorde ne the lady liketh nat to sitte.
Nowe hath eche ryche a reule to eten by hym silve
In a privey parlour for pore mennys sake;
Or in a chaumbre wyth a chymney, and leve the cheef halle
That was mad for melis men to eten inne."*

years afterwards, another complaint was made to the king, that the regrators burned stinking fat and suet before their doors, which so corrupted the air, that the scholars were often sick, and by the smell brought into infirmities. Edward III. compelled ecclesiastical persons to repair and clean before their doors, as well as laics, from which they had claimed an exemption. In 1338, a complaint was again made to the king, that dung, garbage, and other filthinesses lying in streets, lanes, and alleys, had so much infected the air, that not only nobles but others of inferior note did decline coming near the town, and scholars and burghers were overtaken with infirmities of body, and many had died. A pestilence raged in 1349. The state of the streets is more remarkable, for "closets" existed in Oxford in 1354. In 1370, the same causes still operating to contaminate the atmosphere, great numbers of students and citizens fell victims to the contagion. For the appalling havoc made by the pestilence in 1448, another cause is assigned, which doubtless had its full share in aggravating the mortality on previous occasions; and this is "the lying of many scholars in one room or dormitory in almost every hall, which occasioned nasty air and smells, and consequently diseases."—A'Wood. Hist. of Oxford, vol. i. p. 362, 434, 486, 597.

* Warton. Hist. Eng. Poetry, vol. ii. p. 53.

The chimneyed chamber was spacious and lofty, and usually formed with a large bay window, looking into the court of the castle. It adjoined the hall, and was used on ceremonious occasions as a reception-room for the guests before they were ushered into the hall of entertainment, and to which they retired on leaving it. At other times this privy, or presence-chamber served, according to the poet, as a dining-room. Another apartment, distinguished as our lady's bower or parlour, and appropriated to the exclusive use of the dames, was that in which they received their visitors, passed their time, and often took their family meals in. The windows of this also opened into the dismal quadrangle, for all were obliged to sacrifice their feelings and enjoyment to security. Only one instance has been observed of an attempt having been made by the builders of these feudal fortresses to enable the inmates to alleviate the languor of body and mind that must have been produced by living in such dungeon-like stifling apartments. In Conway Castle, below the Queen's oriel, is a little fairy-terraced harbour, or garden, into which, though all on the outside of the moat were enemies, the ladies might venture with personal safety, and enjoy a view of the magnificent and varied scenery around them, and breathe

> " So swete an aire
> Of the eglantere, that certainly,
> There is no herte I deme in such despayre,
> Ne with thoughts froward and contraire
> So overlayde, but it should soon have bote,
> If it had once felt this savour sote."

The strong hold of Conway is further remarkable for exhibiting another domestic refinement, not found, except at Kenilworth, in any cotemporary building. A hearth is recessed into the wall, and has a flue

rising from it for the passage of the smoke into the air. It is true, that after this period, flued fireplaces were sometimes made in rooms that had been erected without them, but the chimney in Conway Castle, and a similar one at Kenilworth, appear as if they had formed part of the original edifices.

But, although the satirist deplores the desertion of the hall, and the introduction of private sitting rooms with chimneys, he draws a vivid picture of the misery of a smoky house.

"Ac, three thynges ther beoth that doth a man to sterte
Out of is owene hous as holy writ sheweth;
That on is a wikkede wif that wol nat be chastede;
Hur fere fleeth fro huere for fere of huere tounge.
And yf hus hous be unhelede and ryne in hus bedde,
He seketh, and seketh or he slepe drye.
Ac, when smoke and smorthre smyt in hus eyen,
Hit doth hym wors than hus wyf other where to slepe;
For thorw smoke and smorthre smerteth hus syghte,
Tyl he be blereyde othr blynde, and the borre in hus throte;
Kowgheth and corseth that crist zgive hym sorwe,
That sholde brynge yn bettere wode, othr blowe til hit brente."

In our days the unendurable proverbial miseries have been reduced to two, which shows, that much as may yet be wanting to comfort in small buildings, they have improved with the advance of the time.

Castles and mansions were now built of stone, but wood and plaster continuing to be the materials of ordinary houses, in towns destructive fires were common, and the custom of strewing the floors with

straw must have greatly increased the danger. Chaucer says:—

"Whan a chambre a fire is, or a hall,
More nede is sodainly to rescowe,
Than to disputen, and ask among us all,
Howe the candel in the strawe is fal."

This frequency of accident, more particularly in London, had led to the enactment of some judicious municipal regulations. The magistrates, says the Chronicle of London, quoted by Strutt, "are empowered to enqyre if there be any house in the ward that is tiled without other thing than tile or lead, and if there be any chemeni that hath a reerdos made uncomli, otherwise than it ought to be." And also if any baker or brewer heat their ovens or other "(furnace) with strawe or reyde or other things that might cause peril of fire." Every ward was also to have "a racke with two long cheynes of yrne and two ladders," and every house was to have a "tub of water ready for peril of fire." The scavengers' oath of office was, that they should examine that all "chemys, reedossys, and furnessys be made of stone for defent of fire."* But notwithstanding these precautions, the history of London and of other towns show a lamentable disregard to the lessons of dire experience in every thing connected with the protection of buildings from fire.

* Horda. Ang. vol. ii. p. 46.

ESSAY V.

Chimneys of some sort, it is certain, were common at Venice before the middle of the fourteenth century. An inscription in marble placed over the gate of the School of Sta. Maria della Carita states, that in 1347 a great many chimneys (*molti camini*) were thrown down by an earthquake. This circumstance is confirmed by John Villani, who died at Florence in 1348. He relates, that on the evening of the 25th of January, in the year named in the inscription, several severe shocks of an earthquake were felt in Italy—at Pisa, Bologna, Padua, and particularly at Venice, where many church towers, and a great number of chimneys (*infiniti fumajuoli*) were overturned.

Chimneys had also been in use at Padua before 1368. In that year, Galeazo Gataro, in his History of Padua, says that Francisco da Carraro, lord of Padua, came to Rome, and finding no chimneys in the inn where he lodged, because at that time fire was kindled in a hole in the middle of the floor, he caused two chimneys like those that had been long used at Padua to be constructed and arched by the masons and carpenters he had brought with him. Over these chimneys (the first ever seen at Rome) he affixed his arms, which were remaining in the time of Gataro.*

* Beckmann. Hist. Invent. vol. ii. p. 104.

These notices have been considered as fixing the chimney to be an Italian invention. But if Winwall House be an Anglo-Norman edifice, its chimneys must have been built in the twelfth century; and those in the castles at Kenilworth and Conway will also long precede, in point of antiquity, the *camini* and *fumajuoli* of Padua and Venice.

The fourth example of a chimney in an English building is that described by Leland, in his Itinerary, where he gives an account of his visit to Bolton Castle. This building, he says, "standethe on a roke syde; and all the substaunce of the lodgynge in it be included in 4 principall toures. It was finiched or Kynge Richard the 2 dyed! One thynge I muche notyd in the hawle of Bolton, how chimeneys were conveyed by tunnells made on the syds of the walls betwyxt the lights in the hawle, and by this means, and by no covers is the smoke of the harthe in the hawle wonder strangely conveyed."*

It has been seen, that, previous to the erection of this stronghold, the word chimeney is of frequent occurrence. Chaucer in several places speaks of chambers with chimeneys; Longlande we have seen also employs it: and Wiclif, in his translation of the New Testament, in 1380, has the expression, "thei schulen send him into the chymeney of fier."

In the poetical vocabulary, "chimeney" appears to be synonymous with "fireplace," or "hearth recess;" and the verbal equivalent to the word in the reformer's Testament is "furnace." Leland, who wrote a century after, in using the word almost defines it. "The chimeneys were conveyed by tunnels;" or, in other words, the fireplace was continued by a tunnel to the top of the building;—a description that will accurately fix the meaning of the word when found in writers previous

* Britton. Arch. Antiq. vol. iv. p. 156.

to the Tudor period; for it is quite obvious the chimneys in common use, and with which Leland was acquainted, had no tunnels to convey the smoke from the hearth—otherwise his admiration of those in Bolton Castle would have been unexplainable. His observation, that the smoke from the hearth was not conveyed by "covers," also shows that at the time he was writing, covers were common appendages to fireplaces for conveying smoke. What these were, must be guessed at; it is most likely they were "canopies" or "pyramids" constructed over a hearth where it was not recessed into the wall, and often also where it was. Underneath this canopy was a hole through the wall for the escape of the smoke, as we now frequently see practised in smithery fireplaces. The invention of smoke tunnels does not appear to have been much valued; for Stoke Castle, erected in the time of Richard II., has a large and capacious hall, built without a chimney; and the timbers of the roof yet show the smoke stains from fires that were made on the hearth in the centre four hundred years ago.*

In the next age, when plague and civil war were depopulating the country, we have numerous notices of magnificent buildings and one of the introduction of a sumptuous decoration. Sudely Castle had the windows of its "hawle glazed with rownd *berals*.† The lord that builded the castle was a famous man of war in King Henry V. and King Henry VI. dayes, and was

* Britton. Arch. Antiq. vol. iv. p. 144.

† Beryl. Whitaker says, these were not beryl crystals, called simply beryls by our lapidaries, but actually beryl *gems*, because said to be "rownd;" and beryl gems, though most commonly columnar like crystals, are yet at times in the form of a round pebble!! Beryls seem to have been formerly more frequent than at present.—Whit. Hist. Manchester, vol. ii. p. 281. Britton, in his Dictionary of Mediæval Architecture, describes beryl to be a species of talc, called by Pliny *lapis specularis*, which, easily splitting into thin transparent plates or laminæ, was in old times used for glazing windows. Specht, in his Glossary to Chaucer, says, beryl means a fine green glass.—Nicolas. Testamenta Vetusta, vol. i. p. 21. The "rownd

an Admiral, as I have heard, (says Leland,) on sea, whereupon it was supposed and spoken that it was partly in the windows of the hawle builded *ex spoliis Gallorum.*"*

Warmth in clothing and in bed was particularly attended to; down beds, blankets, and sheets, were highly prized articles; and in imitation of the Italian taste, the bedstead was an object on which much decoration was lavished. It was sometimes, although a musty practice, made a sort of safe for money and other valuables, and was moved from town to country as the great personage moved himself. The high value set on comfort in nocturnal climate is amusingly exhibited in the formality with which bed and bedding are bequeathed by persons of rank and wealth to members of their family;† at a time when mattresses, sheets, blankets, and counterpanes, were furnished to the Alms-houses of the Gild of St. Giles, at Lynn, in Norfolk,‡ and were common among the middle classes. The inventory of the effects of John

pebbles" that Whitaker's poetical imagination magnified into gems, were most likely the pieces of knob glass found on all plates of blown glass, and which in the high windows of the hall would look as clear as beryls with a slight grinding.

* Itin. vol. iv. p. 75.

† Richard, Earl of Arundel, beheaded in 1392, bequeaths to "my son Richard a standing bed called 'clove,' also a blue bed of silke, which is *generally* at Rygate. To my daughter Charlotte my bed of red silke, which is generally at Rygate. To my daughter Marishal my blue bed, usually in London."—Nicolas. Testamenta Vetusta, vol. i. p. 131.

Edward, Duke of York, the restless and infamous, who describes himself of all sinners the most wicked, bequeaths "To my dear wife Phillipa my bed of feathers and leopards, with the furniture appertaining to the same." Anno, 1415.—Ibid. vol. i. p. 187.

Katherine Lady Hastings bequeaths, "To my son George a goode fedder bedde, a boulster, a paire of blankets, a payre of fustians, and a payre of fine shetes. I will that Cecilie (Marquesse of Dorset) have my bedde of arras, tillor, testor, and counterpane, which she late borrowed of me." Anno, 1503.—Ibid. vol. ii. p. 454.

‡ Richards. Hist. of Lynn, p. 434. The inhabitants of the borough were so prone, about 1488, to walk barefooted that "to prevent the Gild Bretheren coming before the Aldermen without shoes and stockings, a rule is made to fine the offenders fourpence to be spent in alms."

Glynn, of Morval, in Cornwall, who was murdered in 1471, shows a profusion of household conveniences—sheets, blankets, coverlets, mattresses, featherbeds, andirons, and other furnishings of the hearth and kitchen.* In fact, not a castle of the proudest baron in the land could show more of the materials of domestic comfort than the house of this small landholder and trader, at the extreme point of the island.

Large houses begin now to exhibit a greater variety of fire-side furniture. The inventory of Sir John Falstofe's effects, in 1459, shows in one room—"Item, j aundiron; Item, j firepanne; Item, j payre of tonges;" and in the same document we are delighted with an entry—"Item, j payre of bellewes in Mrs. own chambre."†

Charcoal and wood were the general fuel. In the Liber Niger, of Edward IV., "cooles" and wood are only mentioned; and in the Household Book of George, Duke of Clarence, under the date of 1469, "viij s by the day" is allowed for "woode and coole from Allhalowetide unto Estyr, as well from Estyr unto Allhalowetide, by the day vs and viij d, or £106 9*s.* 4*d.* by the year," which is a very large sum for this article when the value of money is taken into consideration, and the abundance of wood that prevailed in England.‡ He gives "iiij s iiij d for 30 burdons of rishes."§

The duties prescribed to the regal menials give some insight into the customs of the palace. One is to be groom porter, "that berith wood, straw, rushes,

* Gilbert. Parochial Hist. of Cornwall, vol. iii. p. 249.

† Archæologia, vol. xxv. p. 278. In the accounts of the parish of Wigtoft, Lincolnshire, 1487, is an entry—"Item, paide for a fire panne to feche fire into the chirche." A shovel is still called a firepan in Norfolk.—Illustrations of Manners, &c., p. 83.

‡ Collection of Ordinances, p. 104. In his wardrobe were 5 down fedder beds and bolsters, 30 fedder beds, and 28 down pillows and 300 libs of down to make more.

§ Illustrations, &c., p. 121.

for the king's chamber, and to fylle the paylettes." Others are "to gader for the kings gownes and shetes, and othyr clothes, the sweet flowres, herbes, rotes; and to make among them other sweete fumes, to make them breathe most holesomly and delectable." This was an age of infection, and the grooms were charged to prevent "from touching of straungers' hands the verry sporrs that the king shall were."*

It was, perhaps, from a desire to diminish the risk of accidents by fire that the custom prevailed of laying the floors with a coating of cement made of lime, and pounded rubbish, or pebbles. The floors in the upper rooms in the old part of the Abbey House, at Waltham, built by Sir Edward Denny, were overcast, or paved in this manner, with a coarse plaster of sand and pebbles, forming a crust about an inch thick, coloured deep red like a bright brick floor, and similar to the rude rough cast or stucco floors seen in some parts of Lincoln and Yorkshire.†

Glass was rare in the windows of gentlemen's houses before the time of Henry VIII.‡ Copyholders and poor people had none. The windows belonging to Contarini, a rich Italian merchant residing in Botolph, were reckoned valuable moveable furniture. And in the riots at Oxford, in 1502, the glass windows were carried away as rich booty by the rioters.§ In London, about 1510, Sir Thomas More, in his Utopia, says, that they keep the wind out of their houses with glass, for it is there much used, and some also with very fine linen dipped in oil or amber; and that for two commodities, for

* Illustrations, &c., p. 40.

† Illustrations, &c., p. 94. In the Church Wardens' Accounts of St. Mary Hill, London, 1485, is an entry—"Paid the dawber for terysing of floris per day viij d;" under the date 1497 is a charge for "a lode of lime to overcast the floore in Lewisham's house."

‡ Antiquarian Repertory, vol. i. p. 72.

§ A'Wood. Hist. of Oxford, vol. i. p. 659.

by this means more light cometh in, and the wind is better kept out. In religious houses it was common. At Alnwick Castle, in Northumberland, when the earl removed to another house, the glazed sashes were taken out of the window frames, and laid carefully by, in case they should be broken by the winds or other accidents, until "my Lord" again visited his mansion. How the wind and rain were excluded after their removal does not appear: the arras and other furniture of household, and kitchen utensils, were carried to that house where the great man meant to sojourn, and his bedding also followed him. In the list of horses there appears, "A horse for my Lord's clothe sak with his bedde, and a horse for the groome of the stable to ride upon that leads the clothe sak horse that carryeth my Lord's trussinge bedde and all things belonging to it, when he rideth his horse."*

Bishop Percy observes, that of all the domestics of this nobleman, four only, the smith, the attorney, the painter and the joiner, were accommodated with separate beds. Few customs, from the prince to the peasant, were more prevalent than several sleeping in a bed;† and bedsteads were made very wide to accommodate divers bedfellows. In palaces and baronial mansions, in eleemosynary foundations, collegiate and religious houses, the dormitories were large hall-like apart-

* Northumberland Household Book, p. 228.

† After the battle of Dreux—"The Duke of Guise remaining master of the field, being overtaken by night, lodged very inconveniently upon the place at Blainville, whither the Prince of Conde was brought to him. It is very remarkable that these two princes, formerly and in the present battle such mortal enemies, reconciled by the variety of fortune, supped together at the same table, and for want of carriages and through a straightness of lodging, lay all night in the same bed; for the Duke of Guise using his victory modestly, receiving the prince with all demonstrations of honour, offered him part of his; the patience of the conquered in the desperate estate of his present defeat was no less considerable than the modesty of the conqueror in the prosperity of his victory." —Davila. Hist. of Civil Wars of France, p. 170, trans. Aylesbury.

ments divided into a number of small spaces by partitions from seven to eight feet high. These enclosures were of size to hold a bed, and were sometimes enclosed on the four sides when the cribs were occupied by females; or open at the end to the room, when appropriated to the beds for men. At Osseney Abbey the beds enclosed in this way were left open at the feet to the room, as to a common passage.* In farm-houses, inns, and servants' rooms in large houses, great beds were formed like platforms raised against the wall by sloping a little from head to foot: on these raised benches was spread the litter, on which the bedding for the servant or traveller was laid. An ancient inn, the Crown, at Ware, in Hertfordshire, had a bed of this description, on which twenty-six butchers and their wives slept on the night of the coronation day of William and Mary.†

Wood, charcoal, and coals, were burned in the castle; but charcoal only was used in the state apartments, "because the smoke of the se cole hurts the arras." Sixty-four loads of great wood were allowed to eighty chaldrons of coals, "because colys will not byrne withowte wood." Brand supposes the coal then exported was of inferior quality, and that they had not at that time got down to the deep strata.‡

* Stevens. Additions to Monasticon, vol. ii. p. 121.

† It was pulled down, with the Inn, in 1763.

‡ Brand. Hist. of Newcastle, vol. ii. p. 263.

In London, coals were not used in great houses. In the accounts of the household of Stafford, Duke of Buckingham, the last entry for fuel is in February, 1509: charcoal and faggots only are mentioned. —Archæologia, vol. xxv. p. 341. In the accounts of the Stationers' Company from 1554 to 1557—Faggots, belletts, and coles (charcoal) only are charged. ¶The hearth was of iron. In 1558, all the windows in the Hall were glazed.—Illustration of Manners, &c., p. 232. The prejudice against coal was still strong in London and in other parts; but in the coal districts, where it also prevailed a century before, it was now worn out. "Halamshire had plenti of woodde, yet there is burned much se cole."—Leland. Itin. vol. v. fol. 94. Again he says, "Though betwixt Cawood and Rotheram be good plenti of woodde, yet the people burne much yerth coal bycawse hit is plentifully found there, and sold goode chepe."—Ibid. vol. v. fol. 102.

This may have been the case; but as no notice appears of any contrivance like a grate on which to burn the coal, some of the difficulty that was found in using it may have been produced from this cause. Even with the best coal, a fire on a hearth would have been very difficult to manage without the addition of wood. At this time coals were sold at five shillings a chaldron.

Wood had become too scarce in Scotland to be used for fuel by the middling and lower classes. In the grants of saltworks that the kings and barons made to religious houses, they gave the right of supplying them with fuel from the forests. The waste from this cause was apparent in the reign of Alexander II. During the wars with the English it was the invaders' custom, according to Knyghton, to burn and destroy the woods in their progress; and in the contests between Bruce and Baliol the same destructive system was continued. When to these sources of decay are added the waste from domestic use, and the absence of the spirit of plantation—the deplorable destruction of the Scottish forests, and scarcity of wood at the close of the fifteenth century, will be easily accounted for. Peats and turves only were burned in the inland parts, but in the coal districts the "common fuel," says Sir David Lyndsay, "is of stone which they dig out of the erth." Under these circumstances, the trade in coals had become of some consequence; and in 1510 the fossil from the "heughs of Sauchie," in Clackmannanshire, was subjected to tithe.* "Iron chimleys" or grates adapted to burn

* Chalmers. Caledonia, vol. i. p. 793. Ennius Sylvius, who visited Scotland about the middle of the fifteenth century, relates that he saw the poor people there, who in rags begged at the churches, receive for alms pieces of stone, with which they went away contented. This species of stone, he says, whether with sulphur or whatever inflammable substance it may be impregnated, they burn in place of wood, of which their country is destitute. Boethius, writing in the beginning of the sixteenth century, says, that in Scot-

fossil coal, that a little after this time are mentioned in inventories, were probably common in the houses in the coal districts in the time of James IV. and his predecessor.

Household improvement, among the lower class, except in the use of coal, seems to have been stationary since the time of Robert Bruce. Sir David Lindsay says, in commendation of the southern Scots, that they are "weill nurtured and lieve in guid civilitie;" and Andrew Borde admits that the people in the south are better than in the north, but yet folks in the "sowthe parte wyll gnawe a bone and caste it in the dishe againe." All ranks were badly lodged; but the dwelling, particularly of farmer, trader, and labourer, was deplorably destitute of domestic accommodation. According to the doctor, on the "borders by Drycol Forest, and so upward to Berwyke, they have no howses but suche as a man may builde in thre or iiii houres. He and hys wyfe and hors standeth all in one rome."* But Arnot, perhaps, oversteps the limit of fair statement, when he affirms that "the meanness of their houses did not arise from want of skill in masonry, but ignorance of every art or refinement in domestic life;" for the gentry in the district described by Borde were as well supplied with the elements of comfort as those of their standing in England; and as alive to their value, if that may be inferred from a resolute attempt to preserve them. In 1513, a complaint was heard by the Scottish Judges against Cockburn, the laird of Skrailing, in Peeblesshire, for

land there are black stones digged out of the ground, which are very good for firing, and such is their intolerable heat, that they resolve and melt iron; and, therefore, are very profitable for smiths and such artificers as deal with other metals. Neither are they found any where else, that he knew of, but between the Tay and Tyne, within the whole island.—Arnot. Hist. of Edin. p. 86.

It is singular that neither Sir David Lyndsay, nor Sylvius, nor Boethius, have a name for coal.

* The Boke of the Introduction of Knowledge, p. 5.

taking by violence a part of his own goods, that had been estreated to Mathew Campbell, among which were arras bed-hangings, sheets, blankets, feather beds, and cods or pillows.*

Though coals and wood in England were not high priced, firing in general was scarce, and in country places the hearths were few. The right to use them was sometimes bequeathed. In 1516, Richard Byrchett, of Pesemershe, says, "I will yt the sayd P'Nell my wyfe shal haue ye chamber she lyes in, and lyberte at ye fyer in the house; all yese thynges shal she haue so long she ys wedo."† In London, however, in the bettermost houses, fires begin to be made in several rooms. In 1524, the house of "John Port, layt the king's servant," three rooms, besides the kitchen, had hearths, besides a most interesting display of fire-side implements. In the hall were, "Item, a pair of andōrs and a pair of tongs, with a fyer rake, with a lytell fyer choffell." In the parlour was "A pair of awdorns cast of yrne;" and Port's own bedroom had "A pair of small andryons."‡ The fire rake is a new instrument, that most likely was the fork with the points turned downwards. If it had this form, it must have been very pleasant to use, and much more convenient than a dust raising shovel, to fish out the unconsumed brands from the ashes.§

* Chalmers. Caledonia, vol. ii. p. 930.

† Nicolas. Testamenta Vet. vol. ii. p. 785.

Sir Thomas Boleyn, in a letter to Cardinal Wolsey, from Paris, in March, 1519, describes the lodgings taken by the Court at a village near Paris on a sudden illness of the Queen. "God knoweth full poorly lodged, but that it (the lodgings) is well dressed with goode stuffs. The great master hath no chimney in his chambre, but there is a great oven." From this communication it is apparent Sir Thomas was accustomed to a chimney, and thought one indispensable to comfort.

‡ Illustrations of Manners, &c., p. 120.

§ In the manor house of Richard Fermer, of Enstone, probably about 1525, are seen rich bed hangings, tapestry, coverlets, blankets, down beds, mattresses, sheets, bolsters and pillows, hangings to the windows, and other appendages of comfort. "His windows, and

The atmosphere of the palace will be best described by quoting some of the regulations made by Henry VIII. for the guidance of his household.

"For the better avoyding of corruption," says the ordinance made at Eltham, in 1526, "and all uncleanesse out of the king's house, which doth engender danger of infection, and is very noisome and displeasant unto all the noblemen and gentlemen repaireing unto the same, the three master cookes of the kitchen shall have yearly twenty marks, to the intent that they shall provide such scolyons as shall not go

the sides of his parlour, were *celyd with wenskette.*" Strutt. Horda. vol. iii. p. 64. Britton. Dict. Med. Arch., art. Wainscot.

An engraving given by Strutt, Horda. plate vii. vol. ii., represents the birth of Richard Beauchamp, Erle of Warrewick, from a painting by John Rous, who died in 1491. The lady is represented in bed, and an attendant is stirring something in a saucepan, that may be caudle, over a charcoal fire, burning on a hearth recessed in the wall; the coals are confined by what appears to our admiring eyes to be a *fender*. This painting, and others forming a series by the same artist, is singular on another account. In the representations of costume in the Saxon and Anglo-Norman eras, figures that are shown in bed have all some sort of night clothing, close garments like shirts, or bed gowns; but in these paintings by Rous, figures are drawn as lying in bed quite naked. The countess above spoken of, is shown covered with an abundance of bed clothes, and pillows, and sheets, and head-sheets, but her ladyship has no night dress whatever. A queen is shown reposing on a magnificent bed, with every thing that so great a personage should have, in the way of pillows, sheets, and blankets, and looking at her crowned babe, but her sacred person, and that of the young prince, are pictured quite naked. In another picture, Erle Richard is shown dying, and receiving the sacrament in bed from a bishop; his lordship is drawn as devoid of all clothing as her majesty. If this was the fashion of the English period, it will account for the great care bestowed on the bedstead and its hangings; for in the barn-like apartments in which they were placed, the ladies, perhaps, in the cold winter weather, made their curtained enclosures serve not only for bed, but for dressing room. Among the upper classes, the comforts of soft and warm beds were much studied; but the lower classes were wretchedly accommodated. "Our fathers," says a chronicler, "have lyen full ofte upon straw pallets covered only with a shete, under coverlets made of dogswain or hop harlots, and a goode round logge under their heads for a bolster. If it were so that the goodman of the house had a mattres or flock bed, and thereto a sacke of chaff to rest his head upon, he thought himself to be as well lodged as the lord of the town, so well were they contented. Pillowes, said they, were meete only for women in childebedde. As for servants, if they had any shete above them it was well, for seldom had they any under their bodies, to keep them from the pricking straws that run oft thorough the canvas, and raced their hardened sides."—Holinshed. Descript. of England, p. 15.

naked, or in garments of such vilenesse as they now do, nor lye in the nights and dayes in the kitchen or grounde by the fire side, but that they may be found of honest and whole coarse garments, withouten such uncleannesse as may be the annoyance of those by whom they shall passe. Of which said scolyons a certaine number shall daily, once in the forenoon, and once in the afternoon, sweepe and make cleane the courts, outwarde galleries, and other places of the court, soe that there remaine no filthe or uncleannesse in the same, but that it may be shortly remedyed, avoyded, and carried away."

"And inasmuch as in the pure and cleane keeping of the king's prevy chamber, with the good order thereof, consisteth a great part of the king's quiet rest, comfort, and preservation of his health," two or more of the groomes of the prevy chamber are to be up early in the morning, "which groomes so comen to the said chamber shall not only avoyde the pallets, but also make ready the fire, dresse and strawe the chamber, purging and making cleane the same of all manner of filthinesse, and in such manner and wyse as the king's highnesse at his upriseing and coming thereto may find the said chamber pure, cleane, whollsome, and meete, without any displeasant aire or thing, as the health, commoditie and pleasure of his most noble person doth require."* His "barbour," also, "is to take especial regard to the pure and cleane keeping of his own person and apparell, and not resort to the company of vile persons or misguided women, lest he might do injury unto the king's most royal person."

On this point Henry was particularly squeasy. One of the articles of impeachment against Wolsey was, that the cardinal, when he had the disorder,

* Collection of Ordinances, p. 155.

breathed in his highness's face. Yet with all this anxiety to inhale pure air, he lived habitually insensible to atmospheric corruption, and endeavoured to avoid its annoyances by the use of perfumes. Every thing in his unpleasant palace was scented; the air of the room, robes, clothes, bedclothes; and Anne Harris, the laundress, after various struggles for an increase of salary, had twenty pounds a year "without further allowance for wode, sope or other thing" for washing table cloths, napkins and towels, and providing as much "sweete powder, sweete herbes, and other sweete things as shall be necessary to be occupied with the sweete keeping" of the linen.*

In the account of disbursements, wood appears to have been a very costly article in housekeeping. In the scullery department is an entry—"Item, coales (charcoal) in the year, by estimation, £324;" and under the head of the wood-yard is another—"Item, in wood for fewel over and above bouch (allowance) of court, £440," making an annual charge of £764, besides other allowances of fuel, one of which amounted to £40 a year for the "furnage of bread" alone.† Charcoal was reckoned the choicest fuel, and allowed in the chief apartments only.

Another charge in these accounts appears enormous: "Item, rushes and straw by estimation £60." In this one palace therefore, during his reign, Henry spent upwards of £2,280 for strewing the floors with dusty rushes and straw—a sum more than sufficient to have covered them with Persian carpets; so true it is that the elegancies of refinement are more economical than the magnificence of barbarian discomfort.

It has been seen that the masters of many houses in these times had seldom household gear for more than

* Collection of Ordinances, p. 216.
† Ibid. p. 196.

one, and that the Earl of Northumberland, one of the richest men in the kingdom, when he went from one of his houses to another, carried the greater part of his furniture along with him. The case was the same with the king: when he changed his lodgings, hangings, beds and other articles were also moved; and certain officers were appointed to perform this service, which was a most expensive one. The lock even on his chamber door was moveable. In the household accounts are entries of monies paid to the smith that always accompanied the court to fix the lock on the door of the king's chamber. On one occasion there was, "Paid to the smith that carried the lock about with the king, vii s vii d;" and at another time there was, "Paid to the smith that carried the lock to Calais, and for his charge all the way, xlvi s vii d." This was, therefore, a most expensive, as it assuredly was a clumsy fastening; at a less charge a proper lock might have been put on the door of every chamber the king slept in during his progress.

The state of the king's kitchen may be inferred from its naked and offensive "scolyons," and the general atmosphere of the palace from the matters they were to remove daily from the galleries and court. In Wolsey's presence chamber the same inconveniences were experienced.

After the cardinal came out of his chapel in the morning, says his gentleman usher, "he demanded of some of his servants if they were in readinesse, and had furnished his chamber of presence and wayting chamber; he being then advertised, came out of his privie chamber about eighte of the clocke readie apparelled, and in red like a cardinal; his upper vesture was all of scarlet, or else of fine crimson taffata or crimson satin engrained. His pillion scarlet, with a black velvet tippet of sables about his necke, holding in his hand an orange, the meate or substance thereof

being taken out and filled againe with a part of a sponge with vineger and other confections againste pestilential aire, the which he most commonlie held to his nose when he came to the presses, or when he was pestered with many suitors; and when he was entered into his chamber of presence, then cry the gentlemen ushers that goe before him bareheaded, 'On masters before, and make room for my Lord.'" *

Disgusting as must have been the air of the palaces, it was purity itself when compared with what was breathed in the houses of the better classes of the commonalty. In a letter to Dr. Francis, Wolsey's physician, Erasmus says, "I often wonder, and not without concern, whence it comes to pass that England for so many years hath been continually afflicted with pestilence, and above all with the sweating sickness, which seems in a manner peculiar to the country. We read of a city that was delivered from a plague of long continuance, by altering the buildings according to the advice of a philosopher. I am much mistaken if England by the same method might not find a cure. First of all, the English are totally regardless concerning the *aspect of their doors and windows* to the East, North, and South; then they build their chambers so that they admit *not a thorough air*, which yet in Galen's opinion is very necessary. They glaze a great part of the sides (of the rooms) with small panes, designed to admit the light and exclude the wind; but these windows are full of chinks through which enters a percolated *air which, stagnating in the room*, is more noxious than the wind. As to the floors, they are usually made of clay covered with rushes that grew in the fens, which are so slightly removed now and then, that the lower part remains sometimes for twenty years together,

* Negociations of Thomas Woolsey, p. 18.

and in it a collection of spittle, vomit, urine of dogs and men, beer, scraps of fish, and other filthinesses not to be named. Hence upon a change of weather a vapour is exhaled very pernicious to the human body. I am persuaded that the island would be far more healthy if the use of these rushes were quite laid aside, and the chambers so built as to let in the air on two or three sides, with such glass windows as might be either thrown quite open, or kept quite shut, without small crannies to let in the wind; for as it is useful sometimes to admit a free air, so is it sometimes useful to exclude it. The common people laugh at a man who complains that he is affected by changeable and foggy weather; but for my part, for these thirty years past, if I ever entered into a room that had been uninhabited for some months, I immediately grew feverish. It would," adds the sensitive Erasmus, "be a great public benefit if public officers were appointed to see that the streets were kept from mud —— and not only in the city, but in the suburbs."

On Tweedside laird Cockburn has been seen pugnaciously struggling to preserve blankets and feather beds and cods, comforts that at a first glance might have been considered unknown in the country, or at least despised by a border rider. Some years afterwards, in a still more remote and uncivilized district, a king and an ambassador were lodged and entertained by a Highland chieftain in a style that could not have been exceeded for comfort and elegance any where. When, in 1528, the Earl of Athol knew the intention of James V. to hunt in his country, the earl "caused to make ane curious pallace to the king, his mother, and the ambassadour, quhairby they were als weill eased as if they had beine in ony pallace aither of Scotland or Ingland, and equivalent for the tyme of thair hunting, quhilk was biggit in the midle of ane griene medow,

and the wallis thairof was of griene timber woven with birkis and biggit in four quarteres as if it had beine ane pallace, and in every quarter ane round lyk ane blockhous quhilkes war loftit and jeasted thrie hous hight. The floore wes laide with greene earthe and strowed with sic floures as grew in the medow, that no man knew quhairon he yaed bot as he had beine in a greene garden. Fardder thair was two great roundes on every syd of the yett with ane gritt drawbridge and ane foussie of sixteine fute deepe and thrittie fute broad of watter. This pallace was hung with fyne *tapestrie* within, and weill lighted in all necessar pairtes with *glaisin* windowis."*

Round towers three stories high, with joisted and boarded floors, and rooms with glazed windows lined with fine tapestry, raised for a temporary purpose in the wilds of Athol, a few years only after the heart of the nation had been broken at Flodden, would almost reverse every popular notion of the utter ignorance or

* Lindsay. Chronicles of Scotland, vol. ii. p. 345. Tapestry had been used in Scotland before this period. When Margaret, daughter of Henry VIII., one of the hunting party, was married to James IV., in 1503, the king's great chamber, and the queen's chamber in Holyrood House, were hung with tapestry, wrought with the history of Hercules and other subjects.—Warton. Hist. of English Poetry, vol. i. p. 206. Arnot supposes that arras was introduced by Queen Mary into Scotland when she returned from France in 1561. At that time, Holinshed says, "she brought with hir many rich and costly jewells of gold worke, precious stones, orient pearle, and such like, as excellente and faire as were to be found within Europe; with rich furniture of householde, as hangings, carpets, and counterpointes, and all other necessaries for the furnishing of hir princelie houses."—Hist. of Scotland, p. 496. A few years after this, John Knox, describing the attack of the mob on the monastery of the Grey Friars, mentions some articles most essential to comfort, (the stale salt beef excepted), where perhaps one would not have expected to find them. "The first invasioun was upon the idolatrie; and thare efter the comoun pepill began to seik sum spoyl, and, in verray deid, the Grey Friers was a place weill providit, that unless honest men had sein the sam, we wald have fearit to report what provisioun they had. Thair scheitis, blancattis, beddis, and covertours, war sic that no erle in Scotland had the better. Thair naiprie was fyne. Thay war bot aucht personis in convent, and yet had aucht punsheonis of salt beif, (considder the tyme of the year, 11 May) wyne, beir, aill, besydis stoir of victuells effeiring thereto."—The Historie of the Reformatioun, p. 128.

contempt of the Highland clans, for personal comfort. Pitscottie quickly dispels this illusion. When the king, says Sir David, was returning from his excursion, the Highlandmen set fire to the mountain palace. "Then the ambassadour said to the king, 'I marvel, Sir, ye lett burne your pallace quherien ye war so weill eased.' The king answereit, 'It is the use of our Highlandmen, that be they nevir so weill lodged al the night, they will burne the same on the morne.'"

At the close of the reign of Henry VIII. domestic convenience and comfort had made a little progress. The rooms in the houses of the upper classes were built capacious and lightsome, and the ceilings were often plastered, or formed of boards. Halls, and parlours, and the chief sleeping chambers, were, as in bygone times, hung with tapestry; or they were lined in a manner recently introduced, with boards of a foreign kind of oak called wainscot. In houses of the inferior gentry and wealthy tradesmen, parlours and the best bed-rooms were hung with arras, or with a kind of painted or sized cloth, made in imitation of it. Stamped or painted leather imported from Flanders was also latterly introduced as a wall lining. The doors were clumsily made and fitted, but well hinged, for Sir Thomas More says those of London would follow the least drawing of a finger: locks were rare, and internal doors opened with a latch and string. Boarded floors in halls and parlours were becoming common.* Rushes and straw, however, still covered and polluted their surface. The beds of the better classes were sumptuous and comfortable. Mattresses were used, but sometimes, to receive the

* In Samlisbury Hall it is curious to observe that the upper floors are massive planks, which, instead of crossing, lie parallel to the joists, as if disdaining to be indebted to them for support.—Whitaker. Whalley.

bed, loose straw was spread on the sacking. The order for making the royal savage's own lair, says, "A yoman with a dagger is to searche the strawe of the kynges bedde that there be none untreuth therein —the bedde of downe to be cast upon that."* The lower classes were contented with straw alone; but, as appears from Holinshed's account, more from an ignorant contempt for a pleasant bed, and a soft pillow, than from lack of means to obtain the indulgence.

The windows had curtains, and were glazed in the manner described by Erasmus; but in inferior dwellings, such as those of copyholders and the like, the light-holes were filled with linen, or with a shutter. The hearth recess was generally wide, high, and deep, and had a large flue. The hearth, usually raised a few inches above the floor, had sometimes a halpas or dais made before it, as in the king's and queen's chambers in the Tower. Before the hearth recess, or on the halpas, when there was one, a piece of green cloth or tapestry was spread, as a substitute for the rushes that covered the lower part of the floor. On this were placed a very high-backed chair or two, and footstools, that sometimes had cushions, and above all high-backed forms, and screens,† both most admirable inventions for neutralizing draughts of cold air in these dank and chilling apartments. Andirons, fire-forks, fire-pans, and tongs, were the implements to supply and arrange the fuel. Hearth recesses with flues were common in the principal chambers of houses of persons of condition; and were superseding what Aubrey calls flues, like loover holes, in the habitations of all classes. The adage, that "one good

* Archæologia, vol. iv. p. 312.

† In the king's withdrawing chamber in the Tower, was "a skrene of wycker, and in a closet over the water staires, was a mappe made like a scryne." In the same apartments were "Twoo rounde pannes of iron, made six square wise, being uppon wheals, to make fyre in." —Retrospective Review, ii. vol. i. p. 336.

fire heats the whole house," was found true only in the humbler dwellings; for in palace and mansion, though great fires blazed in the presence chamber, or hall, or parlour, the domestics were literally famishing with cold. This discomfort did not, however, proceed from selfish or stingy housekeeping, but rather from an affectation of hardihood, particularly among the lower classes, when effeminacy was reckoned a reproach. Besides, few could know what comfort really was, but those who did, valued it highly. Sanders relates that Henry VIII. gave the revenues of a convent, which he had confiscated, to a person who placed a chair for him commodiously before the fire and out of all draughts. Domestics and workpeople too were well fed. The Spaniards who came to England in Queen Mary's time, wondered when they saw the large diet used by the inmates of the most homely looking cottages. "The English, they said, made their houses of sticks and dirt, but they fare as well as the king; whereby it appeareth, says Harrison, that they liked better of our goode fare in such coarse cabins, than of their own thin diet in their princelike habitations and palaces." With beef and bread for breakfast and dinner, and something heartening for supper, consolidated with plenty of good ale, their organic heat was not diminished from lack of its proper fuel, which certainly was a prodigious alleviation of the fireside privation in wintry weather. All classes, moreover, adopted a judicious system of clothing. The flannel in general use, the wadded petticoats and worsted stuffs and brocaded silks, so thick as almost to stand alone, for gowns, were much better calculated to resist cold and damp than the cobweb fabrics worn by modern females; and the men's clothes were of a more substantial texture, and made much fuller than the scanty modern corresponding garments of thin superfine broad cloth.

The thick woollen dresses of the monks also were well contrived for preserving a comfortable portable climate. No part but the face was exposed to the external air, and this was protected by the cowl, so that they were always defended from currents of cold air in the cloisters and vaulted aisles of the now desolate monastic edifices. But nothing was done to improve the air in such places as the courts, galleries, and rooms, in the unpleasant palace at Eltham, or in Wolsey's presence chamber, or in the houses that excited the disgust of Erasmus. The fatal effects of imperfect ventilation, and careless domestic habits, were seen in the deplorable waste of life by the sweating sickness in every town and district of the kingdom; and it continued its ravages among them even when in other countries. On one occasion the sweating sickness broke out in Havre de Grace, and so horrible was the mortality, says Davila, that in a few days it consumed the greatest part of the English army.*

Instead of removing some of the causes that aggravated this disease, fumigation was practised universally, as having sovereign efficacy to avert infection; chamber windows were kept shut, and opened only when the sun shone with vigour; and every morning the house was perfumed with tar and angelica seeds, or some other aromatics, burned in a perfuming pan; flowers and sweet herbs were distributed throughout the house, particularly in bed-rooms, that the inmates "might be recomforted, cherished, revived, and refreshed, with sweete odours," which along with the drinking of pure good wine, were thought the best means of preventing their falling into the languishing extremity of this perilous disease.

* Hist. of Civil Wars of France, p. 182.

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ESSAY VI.

In the Italian buildings erected during the fifteenth and sixteenth centuries, flued fireplaces are always introduced; and the precepts for their construction that most attracted attention, were those given in the works of Palladio.

"Chimneys," says this greatest of modern architects, "are made in the thickness of the wall; and in order that they may convey the smoke into the air, their funnels are raised above the roof. These funnels are not to be made too wide nor too narrow, because if they are made too wide, the air eddying through them will prevent the free ascent and escape of the smoke, and when too narrow, the vapour not having a free passage, will accumulate in the funnel and return into the room. Therefore the flues to chimneys of rooms are not to be made less than six inches deep, nor more than nine inches, and two feet and a half long; and the mouth of the pyramid where it joins the funnel must be made somewhat narrower, that should the smoke be driven down, it may meet with an impediment to prevent its flowing into the room. With the same intention some," continues Palladio, "make the funnel crooked, that by this construction and the force of the fire which drives the smoke upwards, it may be prevented from flowing back. The top of the flue, or the orifice at which the smoke escapes into the air, ought to be wide

and kept at a distance from any combustible substance.*

By the restorers of ancient architecture, chimney shafts, though necessary, were considered to be excrescences on the design. In edifices designed in forms derived from temples, theatres, and other ancient buildings, with their parapets and roofs decorated with vases, statues, and pediments, the introduction of chimney shafts destroyed, in the eye of taste, the antique impress attempted to be given to the composition. A shaft rising from the apex of a pediment, or from the cornice of a façade, or coping of its parapet, would have been an eye-sore like a cocked hat placed on the Apollo Belvidere. To avoid the necessity for this barbarous combination, the Italian architects formed the hearth recess in the internal walls, and by this disposition, brought the chimney shafts into a situation where, if they could not be hidden, they could be grouped and disguised to have the appearance of something they were not, and be thus made to harmonize better with the general character of the building. It was rarely that the hearth recess was made in an external end wall, and then it was seldom indicated by any projection. The chimney shaft was placed on the parapet as a base, or appeared to rise from a plinth or pedestal placed on the cornice or roof.

At this period, when the Italians were raising palaces and villas unequalled for their beauty, the English architects, whose eye had been educated amid combinations seen in buildings of the pointed style, practised a manner of design most extraordinary in its display of magnificence in plan, and Vandalism in the taste and application of decoration. Immense windows and an absurd exuberance of frittered and

* Palladio. J. Quattro Libri, &c. l. i.

pedantic ornament, made their edifices appear better adapted for aviaries, than for protection from a cold humid variable climate like that of England.* In such houses, Lord Bacon said, one did not know where to be out of the sun; and maugre their great fire-places, and blazing logs, he might with equal truth have added, nor where, in winter, to be out of the cold unless one stood within the chimney.

In buildings erected, from the conquest to the close of the reign of Henry VIII., the rule appears to have been to make the hearth recess in the outer wall, and between the windows. The fire in this situation, had one advantage; placed in the shade, its heart-inspiring ruddy blaze was always the smiling eye of the room, that was never rendered vapid or dim by a bright sun-light glaring on the hearth, converting the soft deep crimson charcoal embers into a collection of white powdery ashes, and altogether extinguishing the lively coruscations of the unwearied flame flickering on their surface. To enjoy from the window, a prospect over a beautiful country while sitting at the fire-side, was a pleasure, perhaps, not coveted by the builders of the interlight hearths, or they would not have made the openings so high from the floor, or paid so little attention to their framing and glazing.

When three or four hearths were thought sufficient in a large mansion, their position and form were of minor importance; but when, in the progress of improvement, a chimney had to be constructed in each of a number of apartments, they became objects of much consequence, both in the interior and in the aspect of the building. The chimney stacks were arranged in two ways on the exterior, one by attach-

* Clarke's Views of Tudor Houses, and Britton's Arch. Antiquities.

ing them like towers to the walls, as at Blithefield and Costessy, the other by resting them on the parapet, as at Thornbury. The first, though not the most frequently practised, is the most ornamental. It is difficult to say which is the most ancient.* Single chimneys of the upper floors often rose like a column attached to the walls, supported by a corbel. The form given to the shafts was the same, whether they rested on a projection or on a parapet; sometimes they were carried up from the parapet like separate columns, in imitation of Venetian chimneys—or they were united at top by a cornice—or appeared like a group of pillars attached to each other.

A third manner was practised when architects, in the reign of Elizabeth, discarded the ancient rule, and in imitation of the Italian practice, placed the hearth recess in the inner wall, and opposite, instead of between, the windows. The shafts were then sometimes made to assume the appearance of a parapet, ornamented in different ways, rising above the roof; but their shafts ceased to be so ornamental to the building as in the earlier fashion. The chimney-piece, however, in its turn became an object on which much architectural decoration was lavished. Situated between the lights, its embellishments were confined within moderate limits by the windows, but the unbroken opposite wall gave space to indulge the utmost caprice and magnificence in decoration; and the builders of those days availed themselves of the opportunity to convert the chimney, from an accessory, into a principal object in the aspect of rooms. It was expanded in width, and often rose to the ceiling. The French architects went farther than even their

* Buckler. Historical Account of Eltham Palace, p. 18.

English cotemporaries. In the palace at Fontainbleau Henry IV. erected a chimney-piece, 20 feet wide and 23 feet high, decorated with lofty Corinthian columns, equestrian statues, and other sculptures. Many of these ancient chimney stacks are peculiar in the arrangement of their shafts in pairs, on the thickness of the wall or parapet, as well as in groups on its length. When a house of two or three stories high, had the chimneys of each floor placed directly over each other, the flue of the basement story was carried up behind the flue of the second story, and that behind the flue of the third floor, with the projection into the apartments. In town houses, where the hearths were placed in the party-walls, there was some reason for the awkward disposition. The effect, however, was, that in a house several stories high, the stack, as it rose, was a serious encroachment on the lodging space in the chambers, besides the unsightliness of the projection, even when masked by the formation of closets and alcoves.

With regard to economy, chimneys in the inner walls saved the heat dissipated by radiation when made in the external wall. This, however, was but of small amount; for, from the great width and breadth of the flue, little heat could be imparted to it by smoke of so low a temperature as that which rose from the fire-place.

But, if their fireplaces and windows were faulty, the sound judgment and good taste of Druell, Moston, Percy, John of Padua, Mascall, Havens, Holte, Thorpe, and other architects of this period, were, in one point, worthy of infinite praise and admiration. Feeling that houses were made to live in, as well as to look at; and that, from the nature of the climate, and habits and wants of the inhabitants, fireplaces in rooms were essential to enjoyment and comfort, they were not ashamed, like the "artists"

who succeeded them, to let the chimney shafts appear in their designs, but, on the contrary, by ornament and position, they brought them forward as essential parts of the fabric, and pleasing and picturesque objects in the composition. This was in truth the period of the triumph and glory of the chimney shaft. Invention was racked for variety of form, and novelty and elegance of decoration; Doric, Corinthian, composite, and other sorts of columns, fluted, twisted, square, polygonal, and elliptical; single, clustered, and in groups; crowned with pediments, scrolls, and vanes; obelisks, altars, vases, all covered with roses, lozenges, frets, guilloches, festoons, armorial bearings, heads of monsters, initials, figures, and a host of other devices, combined with a most fantastic and capricious imagination, gave a superlative lightness, and grace, to the parapets and roofs of Tudor houses. And this external elegance was moreover accompanied by a workmanlike finish of the flue ajutage, that corrected some of the evil produced by the prevalent error, in construction of the hearth recess and intervening smoke-duct. Where the original arrangement of the apartment has not been altered, chimney pots and cowls, that vulgarize the sky lines of a modern building, are seldom found necessary on these exquisite chimneys.

Wood, where it could be obtained, was the ordinary fuel, and was still considered the most salubrious. It must, however, have been high priced, for it was a public complaint that wood, particularly of scantlings, required by the carpenter, was becoming scarce; and this was attributed to the practice of felling trees,

* The chimneys of Thorpland Hall in Norfolk, and of Cheyne in Buckinghamshire, exhibit a great diversity of ornament; but perhaps, no other ancient edifice furnishes so elegant a variety of clustered ornaments as Thornbury Castle; they are more numerous and delicate than those of any other part of the exterior.—Buckler. Hist. Acc. of Eltham Palace, p. 18.

even of a large size, for fuel. To remedy this, Elizabeth, in the first year of her reign, issued a proclamation, that no oak, beech, or ash tree, that was one foot square at the stubb, and growing within fourteen miles of the sea or any navigable river, should be converted to coal or fuel, "as being a debasing of that which, if nature did not at first intend, necessity must employ for better service."*

This waste of timber was noticed by Harrison, who feared that if the woods decayed as fast in the time coming as in time past, "turf, gal, brome, heth, brake, whinnies, dies, ling, hassocks, flags, strawe, sedge, reede, rushe, and seacole, would soon be good merchandise even in the city of London; whereunto some of them have gotten and taken up their innes in the greatest merchaunds parlers." Among the combustibles enumerated, coal was that, perhaps, to which he chiefly alluded, as beginning to be substituted for wood. For centuries there had been a considerable consumption of the mineral by brewers, smiths, dyers, and others; yet it was not till about 1561 that the trade in coal, for domestic purposes, may be said to have commenced.†

The previous reign was distinguished for the number of palaces and palace-like mansions that were erected; and, although the Queen was neither a builder nor a renovator, like her father, during her sway the stone and mortar mania had no intermis-

* Fuller. Worthies, vol. i. p. 133.

The price of fuel seems to have varied very little from 1217 to 1592. In the time of Henry III., to bake a quarter of flour, there was allowed for "Growt, furning, and wood, 6 pence;" in 1495, (Edward V.) the allowance for "furnace and wood was 6 pence;" and in 1592, "furnace and wood was 6 pence;" this uniformity is the more remarkable, since under Henry III., the whole charge for baking a quarter of flour, including wood, journeymen and apprentice, wages, salt, yeast, candles, allowance for by day, and bran, was 13 pence. In 1495, the charge was 2 shillings; and in 1592, it amounted to 6 shillings and 10 pence.

† Gray. Chorographia, p. 33.

sion among the nobles. So great was the improvement in the first class of habitations, that in magnificence and stateliness the house of a baron matched with some palaces of princes in former times; and the taste for building was greatly fostered among the middle ranks by the accidental circumstance of a great number of old hall houses and farmsteads falling into decay, being replaced by others of a somewhat more substantial construction.

The peculiar sites of these mansions were chosen on account of shelter from the prevalent strong and fierce winds. "It is that grievous inconvenience that enforceth our nobility, gentry, and commonaltie to build their houses in the valeis, leaving the high groundes unto their corne and cattel, lest the colde and stormy blasts of winter shoulde breede the greater annoyance. Whereas in other regions ech one desireth to set his house aloft on the hyll, not onely to bee sene afarre of, and cast forth their beames of stately and curious workmanship into every quarter of the country, but also for coldnesse sake of the ayre, sith the heate is never so vehement on the hyll top, as in the valey."* This snug and sheltered situation assuredly somewhat compensated, in the bleak weather, for the errors in the construction and arrangement of almost all of these bulky structures, but in the summer it greatly aggravated all their inconveniences.

With the exception of regal and baronial mansions, the greater part of the houses throughout England were mostly one story high; except in towns, a two storied habitation was a mark of distinction, and were constructed of timber, but in parts of the west country, they were built of stone, and some few houses in London were of brick. This partiality for wood was, however, as much from taste as economy,

* Holinshed. Des. of Britaine, vol. i. fo. 37.

for Holinshed says, they might have been built at nearly the same expense of one material as the other. In the woody districts, fabrics were strong, and so well timbered as not to have more than 6 or 9 inches between stud and stud. But in tracts, such as the Fens, where wood was scarce, no studs were used, but only "raysins, groundsells, transomes and upright principalls, with here and there an overthwart post in the walles, whereunto they fasten their splintes and radles, and then cast it all over wyth clay to keepe out the winde," or strike them over with a rough plaster, which was afterwards whitened, and ornamented with a fine mortar, often beautified with figures and other curious devices. In other cases, instead of clay, bricks were used to fill in the spaces between the timbers; and instead of being plastered over, they were laid so as to form zig-zag, lozenge, and other simple patterns on the face of the wall. This was a very common method in Kent and Essex. They had large porches before their entrance doors, and generally one large hall, or parlour, or kitchen, the other rooms were comparatively small.

Town houses, more pleasing to the painter's eye than comfortable for habitation, were built with one story jutting over the other, so that when the streets were narrow, the people in the upper stories on opposite sides of the street might not only converse with each other, but shake hands if so minded. The fashion was carried to an absurd excess; Ray saw an old house at York, of which the upper story projected 15 feet beyond the foundation.* In towns, more especially in London, where the houses were generally three or four stories high,† they were full of rooms with low ceilings, built at random, without anything

* Itinerary, p. 166. † Hentzner. Travels, p. 89.

of contrivance, having steps from one to another, and blind staircases. Although their fronts were nearly composed of glass, with the windows projecting, the apartments were dark, as if the inhabitants were afraid of light and good air, and loved to play at hide and seek.*

The protection from heat and cold afforded by such houses was very different. In the woody districts where the framing was substantial, and the glazed surface of moderate superficies, they were warm in winter and cool in summer; but in the fenny districts, where wood was scarce or high priced, the walls were slight; and in towns where every thing was flimsy and sacrificed to ornament, the houses were "summer ovens and winter icehouses."

The inconvenience of summer heat was still attempted to be removed in the ancient manner. Lemnie, a physician of Zealand, giving an account of a visit he made to his son who had settled in London, says, "The better to qualifie and mitigate this heate it shal be very good to sprinckle on the pavements and coole the floores of our houses or chambers with spunging water, and then to strewe them over with sedge, and to trim up our parlours with greene boughes, fresh herbes, or vine leaves, which thing, although in the Low Country it be usually practised, yet no nation more decently, more trimmely, nor more sightly than they doe in Englande. Therefore frankly to utter what I think of this famous realme, I must needs confesse it doth surmount and carry away the pricke and prize of all others. And besides this the neate cleanlinesse, the exquisite finenesse, the pleasaunt and delightful furniture in every point for household wonderfully rejoiced me. Their chambers and parlours strewed over with sweete

* Neve. City and Country Purchaser, art. Building.

herbes refreshed me. Their nosegays finely intermingled with sundry sortes of fragrant floures in their bedchambers, and privy roomes with comfortable smell cheered me up, and entirely delighted all my senses; and this I do thinke to be the cause that Englishmen living by such wholesome and exquisite meate, and in so wholesome and healthful ayre be so fresh and cleane coloured, their faces, eyes, and countenance carrying with them, and representing a portly grace and comliness giveth out evident tokens of an honest minde."*

Perlin, a Frenchman who visited England in this reign, adds some particulars to the foregoing statement. The tapestry and painted cloths, he says, were well executed; and the common pattern was a profusion of crowned roses and fleur-de-lis, there being few houses in which such hangings were not found. He compares the shops in London to those of the barbers in France which are open; the lights in the lower as well as upper rooms in tradesmen's houses in every town were glazed, and in the windows were plenty of flowers. The seats of the taverns were covered with cushions for the comfort of travellers, and their wooden floors and those in private houses were carpetted with straw and hay;† which is alluded to in the old play, where it says, "Their honours are upon coming, and the room is not ready.——Rushes and seats instantly."

In the houses of gentlemen, citizens, and farmers, the furniture, when compared with that in former times, had grown "in a maner even to passing delicacie—and it was not geasone to behold generally their great provisione of tapestrie; Turkey worke, pewter, brasse, fine linen, and thereto costlie cup-

* Touchstone of Complexions, p. 48.
† Perlin. Antiquarian Repertory, vol. iv. p. 511.

boardes of plate.* In time past the costlie furniture stayed there, wherease now it is descended lower, even unto inferior artificers, and most fermers, who have learned also to garnish their cupboardes with plate, their beds with tapestrie and rich hangings, and their tables with fine napery: and I do rejoyce to behold how that in a time wherein all thinges are growne to most excessive prices, we doe yet find the means to obtain such furniture as heretofore had been impossible." "Old men yet remember so common were all sortes of treene vessels that a man shoulde hardly find four pieces of pewter, (of which one was peradventure a salte) in a goode farmer's house; and yet for all this frugalitie, (if it may be so justly called), they were scarce able to live and paye their rentes at their dayes, without selling a cowe, or a horse, or more, although they payde but foure pounds at the uttermost by the yere. Although at present the four pounds bee improved to forty or fiftie, yet will the fermer thinke

* Bellows were made very ornamental furniture in this reign. They were often of fantastic forms, and inlaid and carved and painted. Ebony inlaid with mother of pearl was a coveted variety that seems to have been imported. The valve-leather was usually covered with green or crimson velvet, and fastened by rows of small gilt or brass nails; some were wholly covered with velvet and studded with nails in a variety of devices, and often with initials of names. The tube was usually very long and made of brass. At the sale of Talma's property, a pair of bellows, which according to tradition, belonged to Queen Elizabeth, were much admired. The wooden panel, or leaf of the bellows, was of a quaint form, with carved wings extending from the upper part. A portrait of Shakspere was painted upon one of the leaves, by Porbus, a Flemish painter of that time; around the portrait were cut some verses in relief, of the following quaint conceit—

"That prince of good fellows,
William Shakespeare,
Whom have we here stuck on the bellows.

O! curst and coward luck
To be thus meanlie stuck.—Poins.

Nay, rather glorious lot to him assigned,
Who like the Almighty rides the wings o' the wind.—Pistol."

—Talma gave 1100 francs for this machine, and it was sold for 3100 francs. Charles Lamb, it was said, on being shown the relic, fell on his knees and kissed it with the most idolatrous veneration.

his gains very small towards the middest of his term, if he have not six or seven yeres rente lying by him therewith to purchase a new lease, besides a fair garnish of pewter on his coweborde, three or four feather beds, so many coverlettes, and carpetts of tapestry, a silver salte, a bowle for wine, (if not an whole neste), and a dussen of spoones for furnish up the sute."*

If the description given by Lemnie and Perlin of the pleasantness of the interior of ordinary English houses be not overcharged, it is certain they far exceeded in cleanliness and comfort the palace of the Virgin Queen. Sir John Haryngton, speaking of a "cloacinian closet," says, that if some invention could be perfected to improve this appendage to a dwelling, it would not only pleasure many great persons, but besides "would do her majesty good service in her palace at Greenwich, and other stately houses that are often annoyed with such savours as where many mouths are fed can hardly be avoided."† These vapours, he observes in another place, do not ascend like smoke, but spread abroad and hang like a dew upon every thing.

From this observation there seems to have been little difference between the atmosphere in the palace at Greenwich, and that which has been inferred was found in King Henry's palace at Eltham. In both cases, the evil was greatly aggravated by the idleness of the domestics, who had to be taught cleanliness by rules and fines. One of the regulations that Sir John proposes to reform this, is, "Item, that all

* Holinshed. Des. of Britaine, vol. i. fol. 856.
The manufacture of a coarse sort of glass had been long known in Sussex, before Jacob Venaline, an Italian, in 1557 introduced the art of making Venice glass into England. Holinshed noticed about 20 years afterwards that lattis in windows was much less used than formerly, because glass is become so plentiful that it was almost as cheap and good as the other. Hentzner mentions that when he visited London, it had many glass houses.—Travels, p. 87.

† Metamorphoses of Ajax, p. 8.

stayres in the house and other roomes that neede, shal require be made cleane on Friday after dinner, on paine of forfieture of every one on whom it shall belong unto iii d." When the matters often found on stairs, passages, and galleries, in these good old frouzy times, are taken into consideration, the long interval between the periods of purification, will show how obstinate was the habit that the regulation endeavoured to correct, and how indifferent on the whole were the mistress and her maids of honour, and of all work, to the contamination around them.

Stuffed seats were common in tradesmen's houses, and Warner, in his Albion's England, makes a "stool half-backed with a hoop, with a cushion made of listes," part of the furniture of a poor man's house in the country; it is not, therefore, without a sufficient reason, that Sir John asks, whether it would not become the state of the chamber to have "easie quilted and lined stools for the lords and ladies to sit on, as great plank formes that two yoemen can scant remove out of their places, and waynscott stooles soe harde, that since great bryches were laide asyde, men can scant endeure to sit on.* It is

* These great nether garments to which the knight so feelingly alludes, were a most ingenious contrivance to make all hard seats comfortable, by enabling every one to carry a cushion in his inexpressibles. In the "Poor Countrey man's Complaint for the loss of his Cattels Tails," some of the materials, in addition to rags, of which they were composed, are enumerated—

"For now of late in lesser thinges,
To furnyshe for theire pryde,
Wyth woole, wyth flaxe, wyth haire also,
To make their bryches wide.
But haire hath so possessed of late
The bryche of every knave,
That none one beast, nor horse can tell,
Whiche way his tail to save."

They were worn of a prodigious size; and Bulwer, in his Pedigree of the English Gallant, speaks of a man who, instead of stuffing them in the usual way, chose to make the space serve as a portmanteau, and drew out of his sloops, that were of the common fashionable size, "a pair of sheets, two table cloths, ten napkins, four shirts, a brush, a glass, a comb, with night caps and other things of

apparent from this that an English palace had not improved in its accommodation for the attendants on the sovereign since the conquest; the Norman's presence-chamber in the Tower, had oak forms, and the floor was covered with hay or sedge; and Hentzner says, that hay was strewed on the floors in the Queen's presence-chamber at Greenwich. The construction of some of the rooms in the palaces was as uncomfortable as their furniture. When the court was at Windsor the maids of honour petitioned the Queen to have the boarded partitions of their chambers carried up to the ceiling, as the pages could gaze in upon them as they went along the passages.

Some of these privations and discomforts appear not a little singular, when the accommodations are considered that were found in private houses, and even in some rooms in the palace; but, in looking at the community in this and preceding reigns, the great magnificence of what may be called the public pageantry of society, and the coarse meanness of its domestic realities, is everywhere apparent. The pompous mansions of the Tudor period are deplorably deficient of all that comfort and convenience arising from a plan suitable to the wants and habits of an improved state of society. The whole interior was sacrificed for a certain display in a small portion of it. In a mansion consisting of eighty apartments, as at Leckinfield, four or five rooms only, says Bishop Percy, were adapted for the use of the noble owners and their guests, the rest were cheerless cabins to sleep in, coarsely plastered and white-washed, with ill-fitted doors and imperfect glazing, or they were appropriated for offices.* In houses of this class, the presence or privy chamber, my lady's

use;" other articles remained that he did not exhibit.—Strutt Horda. vol. iii. p. 89. As far as it went, this portable climate must have been nearly as perfect as an Esquimaux's.

* Strutt. Horda. vol. iii. p. 101.

chamber or bower, and two or three bed-rooms, form the list of what would now be called, from their finishings and furniture, habitable apartments. In the presence chamber the walls were hung to a part of their height with tapestry, or they were lined with panelled wainscot, ornamented with a profusion of carved ornaments, that often also covered the ceilings, or with stamped leather having gold devices on coloured grounds, that came into fashion in the time of Henry VIII. The doors were clumsy, and still coarsely hinged and fastened. It had shutters secured by rough bolts and padlocks. The furniture was scanty for a room of its dimensions, and some of it, such as the forms and stools and tables, were coarse and cumbrous for an apartment that in other respects affected splendour. The chairs, often of ebony, were very high backed, much carved, frequently stuffed (notwithstanding the example at the palace) both in the seat and back, and covered with velvet or tapestry. The windows and doors in the public rooms and bedchambers, had velvet or tapestry or silk curtains. The bedstead and its accessories were sumptuous. The floors were covered, or partly so, with rich foreign carpets or Spanish footcloths, on which were placed low stools, footstools, and cushions were placed on the window seats. The rooms had fireplaces with gorgeous chimney pieces, ornamented andirons, fire-forks, firepans, and tongs, and when need required the slumbering embers were roused into activity by bellows, covered with velvet; nothing here was wanting but a relish for refinement, a taste for the amenities of domestic comfort, to blend these elements into one consistent and harmonious whole, by a more scientific and economical distribution of heat from the hearth, and above all by a thorough and regulated ventilation; neither of which were understood. From the height of the

mantel of the hearth recess, and the width of the flue, the radiant heat alone of the fuel could warm those near the fireplace; the air of the house, when fires were not burning, was impregnated with effete animal and vegetable exhalations, that were attempted, but in vain, to be removed by the use of the perfuming pan, and by the introduction of fragrant herbs and flowers into the apartments. To fumigate rooms was a trade which Shakespeare alludes to, when he makes one of his actors say, that he was "entertained for a perfumer when he was smoking a musty room."

These evils were tolerated from habit, not from ignorance, for the public was familiar with the most judicious precepts for the preservation of health, and the construction of buildings. "For health's sake," says Lucar, one of the neglected monitors, "let the principal doors and windows of your house be open to the north-east, south-east, south-west. Moreover, make all the rooms within your house lightsome, of a convenient height, and of a laudable largenesse. Build in *every chamber* within your house a *chimney*. Lodge always in a high chamber, that is severed from the roofe with a floore betweene, rather than in a roome belowe, and beware you do not sleepe at any time in a close place nor upon the ground. And in no wise suffer a stable, ox stall, standing poole, filthy ditch, or stinking sink, to be neare your house or garden."*

An apparatus for heating, in use at this time, is noticed by Archdeacon Nares, in his Glossary, on the authority of a passage he quotes from Green's Quilp, "They use no rost but for themselves and their household, nor no fire, but a little *court chimnie* in their owne chamber:" probably, says the archdeacon, "it was a chimney built in a corner of a room, or else it was some-

* Lucar Solace, p. 152.

thing of a stove." Scammozzi describes a contrivance that in all probability is the court chimney alluded to. He says that in England there is a method practised to heat a room by means of a door of plate iron, hung to be moved easily, so that you can open or shut the smoke passage at pleasure. This door being raised up the smoke passage is open, and being down the smoke passage is shut. When a brazier of charcoal or wood is well lighted, which may be done in a short time by means of a couple of brands, the pieces are then withdrawn which produce the smoke, and the iron door which closes the chimney is shut, after which no more of the heat is exhaled by the flue, but, on the contrary, it spreads itself through the room, and heats it as well or even better than a stove.*

This simple iron door may, however, with justice be considered one of the most useful inventions of modern times; and one, that even now, at a trifling expense would be of infinite advantage to millions of chimneys in every country; but it does not seem to have been valued, according to its merits, among our ancestors. It is now well known among us under the name of the *register plate.*

Sir Hugh Platt, an ingenious lawyer, was among the first who attempted to improve a smoky chamber by operating on the fireplace, from which it is evident that he understood the seat of the evil. "If the smoking chimneys that want helpe," says Sir Hugh, "be large, and carry some good length and breadth with them, then erect or builde a false back or sides, so as there may be a distance of 3 or 4 inches betweene the olde backs and the new, and raise this work a foot above the mantel-tree." This construction, he assures us, is "warranted by a gentleman of Ireland, who is a great practiser of artificial conclusions." And, in

* Savot. L'Architecture Françoise, p. 160.

as far as it not only diminished the width of the hearth recess, but greatly contracted the throat of the flue, it was a considerable improvement.* To defend the mantel trees and other wood near the fire, he directs them to be painted with a mixture of equal parts of fish glue and alum dissolved in vinegar.

In his description of "a conceipted chaffing dish to keepe a dish of meate long hote upon the table without any coles therein," Sir Hugh says, that from this invention sprung what are called froes, or pans, to heat beds with, and cast one into a kindly sweat. The like device is also used by others, who place "iron pinnies (or heaters) into hollow boxes of wood, first lined inwardly with metal, or into iron chests, either to lay under their feet where they use to write or studie, or in their coches to keep their feet warm. The now distressed king of Portugal caused a paire of wooden soles to be made for a paire of shoes which he had to set in, and which he would warme at his pleasure with mars well rubified."† For the ventilation of noisome vaults, Platt's scheme is efficient and practical; he directs a vertical funnel, built to a convenient height, to be connected with the drain or vault, and the offensive air as fast as it is produced will rise in the funnel and be dissipated in the atmosphere.

His favourite project was to sweeten sea coal, so as to make it a substitute for wood in domestic economy. This he accomplished in various ways. In the winter season, after a few frosts, as much loam is to be gathered as is necessary: half a peck of it is to be dissolved in a tub of water, and mixed into a very fine pap. A bushel of the best sea coal is to be strewed upon a paved floor and bruised with a hammer, or by treading under foot. The coals are

* Platt. Jewel House of Art and Nature, p. 72. 1594.
† Ibid. p. 28.

then to be spread some handfuls thick upon the floor, and some of the thin loam pap sprinkled evenly over them; they are then to be turned with a shovel, and again spread on the floor, and sprinkled with more of the loam pap, and this process is to be continued until the mass of coal and loam is soft enough to be made into balls with the hand. These are to be placed in rows without touching each other for a few days until they are thoroughly dried, when they are ready for use according to "the manner of Lukeland in Germanie, which forme of firing hath beene with them many years past."*

* Platt. A New Cheape and Delicate Fire of Cole Balles, p. 5.

Ray saw this kind of fuel when he visited Lukeland or Liege, in 1663. "At Luyck, he says, they also use for fewel a sort of round balls made of clay, mixed with a certain proportion of coals beaten small, tempered together, and dried in the sun, which they call *hot shots*. These we never saw used any where else. They serve to slake the heat of a fire, and keep the coals from burning out too fast."—Journey, p. 585.

The same sort of fuel is now used in Wales. According to Forster, "stone coal culm, from its slow combustion, and the long steady heat it is capable of affording, is well adapted for lime burning, and large quantities are exported for that purpose, mixed with clay so as to form balls; it is also extensively used in Wales for domestic purposes. In the cottages of the peasantry in the counties of Glamorgan and Carmarthen, and more especially in Pembrokeshire, these balls form the principal article of fuel. The culm and clay being first thoroughly mixed by the bare feet of one or other of the female part of the family, are moulded into balls of an oval shape, and the good housewives not unfrequently display their taste by the fanciful way in which they place these balls edgeways in the grate, each row being inclined at a different angle, and under the active influence of that passion for white-washing, which, extending from the church belfry to the pigstye, adds very materially to the picturesque nature of Welsh scenery, they are not unfrequently together with the bars of the grate white-washed also. These balls are, as may be readily supposed, difficult to ignite, but being once lighted, burn for a great length of time, and being renewed at the top as they slowly consume, the fire is not allowed to go out, in some cases for many years,—such a catastrophe would indeed be regarded by a thrifty housewife as an unluckly omen. The appearance presented by a fire of this description, with various articles of linen hung up to dry, absolutely in the chimney, for the balls like stone coal emit neither smoke nor flame, is not a little singular to one accustomed to the bleezing ingles and black diamonds of the north of England." —Trans. of the Nat. Hist. Society of Northumberland, p. 94. 1831. This preparation of fuel has been the subject of several patents. The cheapness of coals, however, prevent coal balls being introduced as firing. As fuel becomes dearer, and its economy better

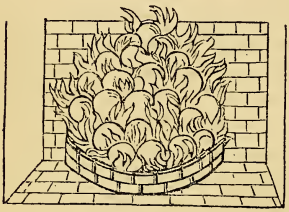
He described other varieties of his fuel. One that he commended as very pleasing and delicate, and fit even for a lady's chamber, was composed of equal parts of coal, and small coal or thorne coal; or, two parts of coal and one of small coal united with the loam binding. To make the thorne coal when large, (which he values at three halfpence a bushel only,) easier worked, it was bruised a little by walking on it. Balls that were formed of one part of earth, one of small coal, and one of coal, mixed with the fluid loam, also made a reasonable good fire. The sweetest fire of all was made with one part of sawdust of the oak, ash, or fir, with two parts of coal, incorporated with loam as before; or equal parts of sawdust and coal, and tanner's bark and coal, with the loam band, made a good fuel. "Many," says Sir Hugh, "have thought my fire to consist of sea cole and cow dunge, but rash pens do soone run riot, yet I do not utterlie dislike this mixture. To speake truelie of it, it maketh a sweete and pleasing fier, and if you bestow labour enough therein, you may make cole bals with it and sea cole without anye other bande. Others would have it to consist of chopt strawe and sea cole, but that conceit I hold not to be worth a straw." *Turf* may also be mixed with coal and the remainder of an old fire may be wrought up into new balls, so that in this kind of firing there is no loss at all. Sir Hugh did not determine whether the "oozes" might be used as a binding medium, but he thought they would answer as well as loam.

The fireplace for burning this fuel was formed by bricks laid edgewise on the hearth, an inch distant from each other; the spaces serving instead of a grate to admit the air to the balls. On these were placed

understood, the hot shots will be looked on with more favour; they form, when composed according to Sir Hugh's directions, a most agreeable fire.

a row of "faucon or saker shot," or when iron bullets were not to be had, coal balls were used instead, and on them another row was placed, until the fire was framed to what height was best, but Sir Hugh always arranged each tier in the form of a semicircle. To light the fire he placed a few pieces of cleft wood and charcoal, or charcoal alone, in the middle of the pyramid. Figure XXVII. is a view of the fireplace given by Sir Hugh. He thought that the balls might be ranged round a core of stone, brick, or iron, and fewer of them would then be required; and they might also be used mixed among billets and charcoal. Anticipating objections to his elegant and economical fuel, and lest the workman be taxed of an unprofitable and needless labour, since a convenient fire may be made of sea coal only without further charge or trouble, he urged that the frugal, thrifty Germans found some advantage in their labour or they would not continue it. And from his own experience he stated his coal balls made a cheaper fire than sea coal, were more lasting and not so dirty, "whereby that black kind of peppering, or sea cole dust," that destroys gardens, and discolours and defaces stately hangings and rich furniture and apparel is avoided; as well as the "hellishe smoke and smoder that is made by stirring up common sea cole fiers after they are caked together. Besides the beautie of the fier doth greatlie commend itselfe, whose forme and shape doth far surpasse all other fiers whatsoever; the balls being round and all of one bignes, when they are truely placed together they do

FIG. XXVII.



much resemble the piles of shot, as they lay in a most beautiful manner within the Tower of London."* And it will be admitted that the elegance and cleanliness of an ignited collection of these balls would justify all his praises.

Throughout the reign of Henry VIII., the population of London began to multiply beyond former example, and the number of strangers resorting to the capital during the reign of Elizabeth also rapidly and steadily increased. This, however, not being met by an adequate augmentation of buildings for their accommodation, the houses, particularly those of the working classes, became so overcrowded as to occasion a well founded public alarm that such numbers being huddled together would engender and disseminate contagious diseases, and the more so, as many of the tenements were in a state of decay, and damp and dark cellars were inhabited as lodging rooms by large numbers of labouring persons. To add to the evil within doors, encroachments, to gain space, were made on the streets, then uniformly narrow, by jutties, stalls, and sheds; and their ventilation was further impaired by the style then prevalent of building the stories of houses overhanging each other. The citizens also complained that the small houses erected in the suburbs, that in themselves were nuisances, shut out the fresh air of the country from their streets. The Queen, so far back as 1580, endeavoured to restrain these practices by a proclamation prohibiting the erection of any dwelling house within three miles of the city gates, and limiting the number of inmates in each house ;† but the evils, too wide spread for a proclamation to rectify, went on increasing until 1692, when the plague entered the crowds and in a few months destroyed twenty-six thousand persons.

* A New and Delicate Fire, p. 14.
† Rutt. in Burton's Diary, vol. i. p. 412.

Even this calamity had no effect in repressing encroachments, or in diminishing what then was a fatal practice, sub-letting; and the following years proceedings in the Star Chamber were commenced against a number of persons who had disobeyed the proclamation, but still without producing the amendment desired by the public, and essential to its safety. Another proclamation was therefore issued in 1602, in which the Queen says "that heretofore in her princelie wisdome and providence, she had foreseen the great and manifold inconveniences and mischiefs which did then grow by the accesse and confluence of people; and that such great multitudes being brought to inhabit in such small roomes, whereof a great part being very poor, and being heaped up together, and in a sorte smoothered with many families of children and servants in one house, or small tenement, it must needes follow that if anye plague, or other universal sickness should by God's permission enter among these multitudes, the same would spread itself, out of which neither her majesties owne person, but by God's special providence, nor any other whatsoever could be exempted." To avert such an evil she again enjoined that no house should be erected within three miles of the city gates, and no tenements should be subdivided into several houses, and in order to "wayve and avoyde that noysome pester of bulkes, stalls, sheds, cants, and jutties, wherewith our streets are in all places so much cumbered and anoyed that it taketh away the benefit of the ayre, swetnes and decencie of the same;" they were to be forthwith pulled down, as well as all houses not built on an old foundation. The deplorable want of accommodation for the poor, and the extortion by the landlord to which from this state of things they were subjected, are forcibly exhibited by the clause in this proclamation, which says that such houses not let, or that were empty,

"were not to be inhabited or let to any, unless the owner shall dispose of them for the benefit of the poor, without houses, and at such rent as the justices shall allow."*

This prophetic warning was fearfully realized about seven months afterwards, when the plague swept off thirty-seven thousand citizens between April and November.†

The gaol fever was another disease, which, in these times, was an object of dread to society. The unfortunate and the criminal alike were immured in damp, cold, ill-aired dungeons, and kept in a state of inactivity.

* Rymer. Fœdera, vol. xvi. p. 448.

† Collection of Scarce Pieces, p. 80.

The history of Chester furnishes a calamitous example of the danger of neglecting public ventilation, from which the government several times attempted, but in vain, to save the capital. 1507. Sweating sickness very sore in Chester for 3 days, 91 died. 1517. Great Plague, grass a foot high in the streets. 1550. Sweating sickness. 1603. Great plague began in one Glover's house, in which 7 persons died; 60 died weekly, and in all 650 persons, besides 61 of other diseases. 1604. Plague very hot, continued increasing, 812 deaths. 1605. Plague still continued, 1313 died of it, besides those of different diseases. 1608. 14 persons died of plague. 1610. Many persons died of plague. The next event in the history of the town will account for some of the mortality in previous years. 1636. "That the Lord Bishop be informed of the unwholesomeness of the puddle near the east gate, and the inhabitants be ordered to cleanse the streets before their respective doors within *one month*, under a fine of 10 shillings. The length of time allowed under the circumstances is most singular. This man, (William Edwards, Mayor,) was a stout man, and had not the love of the commons. He was cruel and not pitying the poor; he caused many dunghills to be carried away; but the cost and time was on the poor. It being so hard times might well have been spared. The mayor caused the dirt of many foul lanes in Chester to be carried to make a bank to enlarge the roodeye, and let the ships in; it cost about £100." 1645. Town besieged for twenty weeks, and subdued at last by famine. "1648. In this year were superadded to the evils which had been endured by the city, the horrors of pestilence, caused probably by the habitual neglect of public cleanliness, and the increased annoyances which would be occasioned by the numbers cooped within the city walls in the preceding siege, (and which had not perhaps been removed); between June, in this year, and April, 1649, following, 2099 persons died of the plague. Grass grew at the High Cross, and in the most frequented parts of the city. Cabins for the infected were built under the Water Tower, and in the adjoining salt marsh."—Ormerod. Hist. of Chester, pp. 197, 199, 203, 209. A public muck heap was not an uncommon appendage to a town. In the annals of Lynn it is recorded, that in "1630 the great muck hill at the East gate was spread over St. Catherine's ground close by."—Richards. Hist. of Lynn, vol. ii. p. 1198.

They inhaled the pent-up noxious effluvia emitted from their own bodies; and from the want of means for personal purification, their clothes and bedding, during their incarceration, became saturated with the fatal exhalations. In this condition the miserable prisoners engendered, and became victims to, a disease of deadly malignity. They sickened, and, with little apparent illness, they died. The prison-house thus was the focus of a contagion, that spread far and wide beyond its walls, and spared few who were so unhappy as to come within its influence. It was remarked, that although a prisoner happened to escape the infection, his clothes nevertheless exhaled a pestilence that scattered death around him wherever he went. The assizes held at Oxford, in 1577, were long remembered and called the *Black Assize*, from the horrible catastrophe produced on that occasion by the gaol fever. Baker, in his Chronicle, tells us, that *all* who were present in court died in forty-eight hours—the judge, the sheriff, and three hundred other persons! So terrible was the retribution suffered by the community for its hardness of heart in denying, even to criminals, those personal indulgences necessary for avoiding disease and preserving life, that may not be withheld, without great sin, from any fellow sharer of humanity!

The historians of this period relate, with just indignation, that nearly three hundred martyrs died at the stake in the "bloody reign" of the bigot Mary. But how insignificant appear the number and sufferings of these regal victims, when compared with the tortures of suffocation and death from stench that were endured by thousands of persons, in this and preceding reigns, when every prison was a legal sepulchre.

ESSAY VII.

That sea coal was coming more into use is apparent from the care to make it more agreeable, particularly to the ladies, some of whom were beginning to introduce it into their parlours. Correcting the poetical anachronism, we may refer to this period the conversation between Dame Quickly and Falstaff, in which, she says to him, "Thou didst swear to me upon a parcel gilt goblet, sitting in my dolphin chamber, at the round table by a sea cole fire, on Wednesday in Whitsun week, when the Prince broke thy head for likening his father to a singing man of Windsor." But she is drawn as a woman of spirit, and in the selection of her fuel also, superior to the prejudices and whims of her neighbours, for the fair sex in general was most hostile to the introduction of coal. It spoiled their complexions. Braithwayte, in his "Complete Gentleman," sneers at the effeminacy of men turning day into night, and courting their *yellow* mistresses in the city; and so careful were the fastidious dames of Cockaigne to avoid the reproach of the "*coal tinge*," they would not go into any house or room where the discolouring fuel was burned; and so far did they carry their dislike, that they would not condescend to eat meat even that had been roasted at a detestable sea coal fire. Ben Jonson, if he did not humour the prejudice, followed the fashion, and when entertaining company he warmed his room with a char-

coal fire; but the poet's common fuel must have been wood or vile plebeian sea coal. This appears from his not being careful to have the flue swept so often as it should have been: Howel advises him to be more cautious on this point in future, and reminds his testy friend that he had twice assisted in extinguishing the flames when his flue was on fire.*

Notwithstanding the prejudice against coal fires, they had made their way into districts where wood, though not abundant, was cheap. In an inventory dated 1603 of the goods of Sir Thomas Kytson, at Hengrave Hall, in Suffolk, we meet with mention of "a cradell of iron for the chimnye to burne secole with;" and as a characteristic accompaniment to this chief among domestic implements, there is also "j fier sholve made like a grate to seft the sea-cole with."†

In the great chamber of this mansion, there were "Itm. two payer of andyorones, with heads and forepart of copper, one payer being less than the other; Itm. two payers of creeper; Itm. two fyre sholves, two payer of tongues, and one fyer forke." In the "winter parlor, Itm. one p'fuming panne of brasse; Itm. one payer of andyerns." In the "summer p'lor, Itm. one payer of andyorns, and in the 'chiefe chamber andyorns and creepers.'"‡ From their hearth furniture, wood seems to have been used in all the best apartments; certainly in those hung with tapestry, to

* The same prejudice exists in Normandy now, where the cold is intense and the firing dear. "Dr. Bennet, a clergyman at Caen, told Mr. St. John that he had received a notice to quit his house because he burned pit coal; and another English gentleman who had invited a large party, finding his drawing-room very thin, and enquiring the reason, found that the French staid away because it was understood that he burned coal. What renders the preference for wood fires more remarkable is, that besides giving much less heat than coal fires, they are far more expensive."—Journal of a Residence in Normandy, p. 43. 1831.

† Gage. History of Hengrave, p. 23.

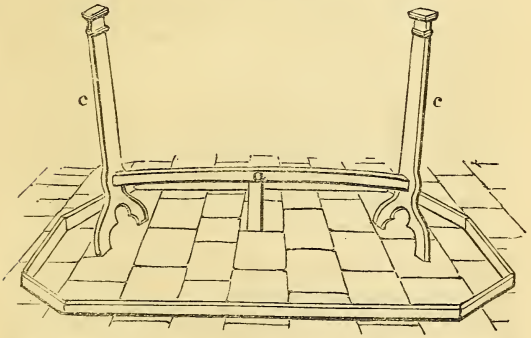
‡ Ibid. p. 29.

which the smoke of coal was reckoned prejudicial. The mineral used was brought from a considerable distance. There is an entry of "sea coles boughte at *Lynne* of ye great measure xx. chal., which of ye small is xxvii. chal."*

These items mark a great stride in the knowledge at least of what was desirable for fire-side comfort. In former times, halls a hundred feet long were attempted to be warmed by one fire, while the great chamber of Hengrave Hall, of much less capacity, had two fireplaces, each with its appropriate gear. Here also was not only a winter parlour made as snug as the skill of the times permitted, but a summer parlour with a hearth equipped to enjoy the cheering fire in the chilly days of the genial season.

The "cradell," whose construction and use will in future form a prominent object in the inquiry into fireside comfort, was probably formed like those made

FIG. XXVIII.



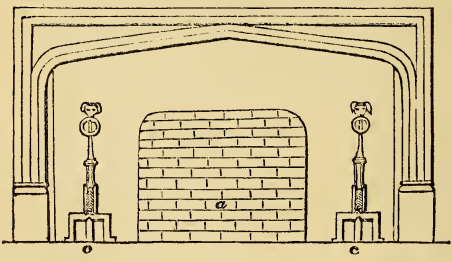
a century later, and received its name from its general resemblance to a piece of nursery furniture. The

* Gage. Hundred of Thingoe, p. 211.

perforated fire-shovel, however, appears rather out of place in any apartment of this magnificent mansion, unless it was the custom in those days to burn the cobcoals only, and to separate them by means of the sholve from the culm before they were laid in the cradle. It is improbable that any dust hating hospitable Suffolk knight could tolerate cinder sifting on his hearth, when the best coals were selling at a noble for the chaldron.

The ancient andiron, as has been stated, was composed of two standards, *a*, *a*, connected by a rod of iron, or billet bar, *c*, as shown in Fig. XXVIII., which is a sketch of the andirons that stood on the floor of the hall at Penshurst.* But when the fire was made in a recess that was very wide and deep, each standard was fixed into the back of the fireplace by a lateral bar, Fig. XXIX. and Fig. XXX.,

FIG. XXIX.

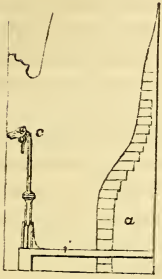


that show the andirons in the hall at Vicar's Close, Wells ;† *c*, *c*, are the standards, *i* the billet bar, and *a* the reredos, or hob that in deep recesses brings the fire more into the room. When the fireplace was of moderate dimensions, the andiron was moveable.

* Hunt. Exemplars of Tudor Architecture, p. 121.
† Walker. Account of Vicar's Close, Wells, p. 38.

In the kitchen, where large fires were made, and large pieces of wood laid on, the standards and billet bars were proportionably massive and strong, but usually plain with very little ornament. In the hall, that ancient seat of hospitality, they were also strong and massive to sustain the weight of the logs of the "glorious Christmas fire." These were more ornamental by the standards being polished and kept bright, or ornamented with brass rings,* knobs, rosettes, heads and feet of animals, and a variety of fantastic and grotesque forms. As its name imports, the implement, in kitchens and in the rooms of common houses, was wholly made of iron, sometimes the billet bar and foot only was of this metal, and the stem and ornaments were of copper as at Hengrave, or the standard was wholly of brass, like those in the long drawing room at Haddon Hall.† Others were highly gilt and enamelled with beautiful flowers in various colours, and disposed with great art and elegance.‡

FIG. XXX.



Sometimes they were fashioned of more costly materials. When Carr, Earl of Somerset, was married to Frances Howard, they received valuable presents from the court-favour hunters. Among others, Sir Robert Mansel and Sir Robert Carey, each gave fire tongs, fire shovel, and creepers (andirons), and all the furniture of a chimney in silver; another cringer laid at their feet a "cradell of silver to burne sea cole in." Sir Charles Wilmot's offering was a warming pan of gold; and at a feast made for the

* Gentleman's Mag. vol. 59, p. 109.
† Rayner. Account of Haddon Hall, p. 2. Supp.
‡ Strutt. Horda. vol. iii. p. 164.

unworthy pair by the city of London, Sir Robert Ingram presented them with all the implements of a kitchen in silver.*

The andirons, "like knights with their squires, were often attended by a pair of younger brothers far superior to, and therefore not to be degraded by the humble name of creepers" that are given to them in the Hengrave Inventory. Indeed they often carried their necks half as high as their proud elders. "I have a pair," says a correspondent in the "Gentleman's Magazine," "in my hall, that are 2 feet 6 inches high, and much ornamented at the bottom; but there is something singular belonging to them, they have each a kind of round pan, about 4 inches diameter and 1 inch deep, hanging loose, whether designed for use or ornament I know not, but when I was a boy, they served me, and have done my children since, to make a noise with."†

These round plates at the top of andirons were a common ornament, and were almost as nicely polished as a convex mirror. A pair at Wombwell Hall had armorial bearings figured on their discs.‡ The com-

* Retrospective Rev. ii. vol. i. p. 391.

† Ibid. vol. 59, p. 109.

"When great chimneys were in fashion, there was at each corner of the hearth or grate a small elevated projection, called the hob (reredos?) and behind it a seat. In winter time the beer was placed on the hob to warm, and the cold beer was set on a small table, said to have been called the nob: so the question 'will you have hob or nob,' seems only to have meant 'will you have warm or cold beer,' that is, beer from the hob or nob."—Brand. Popular Antiquities, by Ellis, vol. i. p. 241.

‡ Ibid. vol. 59, p. 400.

The orthography of the word is very arbitrary; endiron, andyorones, andyorns, andyerns, aundiron, awdōrns, andryons, aunderirons; in Glynn's Inventory it is written andyeris; and in that of the effects of Sir Peter Frethevile of Stavely, the word is written launde iron. Skinner suggests three derivations—andirons or handirons, irons that may be moved by hand; endirons from their supporting the ends of the wood; brandirons, as if a corruption of a Saxon word to burn. The "creepers" have their general designation from being of lower height than the andirons; but like their principals, they have also received names from their ornaments. In Kent, and also in Shropshire, and neighbouring counties, the andiron is called a cobiron, and the creeper, a "fire dog," or a "fire cat," according to

mon sort of creepers had no standards, or very low ones, and their feet were connected by the billet bar. The office of the creeper was the same as that of the andiron, to keep the ends of the brands from the hearth, in order to produce a brisker combustion. Andirons and creepers are still in use in many old mansions, in woodland districts where wood continues used for fuel.

The introduction of chimneys into many districts was very slow. The farmers in Vale Royal, King tells us, "in their building and furniture used (until about 1616) the old manner of the Saxons, having the fire in the midst of the house, made against a hob of clay, and their oxen also under the same roof;"* but after that they built chimneys, and furnished their houses accordingly. The air of their dwellings must have been pure as that of their district, if King's account be true, who says the people of the country are seldom infected with diseases or sickness, neither do they use the help of the physician near so much as in other countries, for when any of them are sick, they make

the shape of its head. Britton. Dict. Med. Arch. art. Endiron. Gentleman's Mag. for 1789, p. 400. Ibid. vol. 58, p. 671. Moveable iron sides to kitchen grates to contract or enlarge the space for the fire, and called "end irons" in Yorkshire, are a modern invention.—Ibid. vol. 58, p. 1060.

* Ormerod. History of Chester, vol. i. p. 103. "Out of the mosses they dig turves every summer, every man as shall serve his turn to burn all the year, which turves in some places when they are dry are reddish and soft, much like a spunge, which burneth fast away, and giveth not so good light or heat as the other sort, which are black and very hard when they be dried, and are much better than the other. Moreover in these mosses, especially in the black, are fir trees found under the ground, (a thing marvellous,) in some places 6 feet deep or more, and in some places not 1 foot, which trees are of a marvellous length and straight, having certain small branches and roots at one end like as if they had been blown down with the weather. These trees being found, (which the owners do search out with a long spit of iron,) or the such like, they are then digged up, and first being sawed into short pieces, every piece of the length of a yard, then they cleave the said pieces very small, yea even as the back of a knife, the which they use instead of candle to burn, and they giveth a very good light. It hath a long snuff, and yet in falling doth no harm, although it should light into flax tow, and such like."—Ormerod. Hist. of Chester, p. 102.

him a posset, and tie a kerchief on his head, and if that will not amend him, then God be merciful unto him. The people live till they be very old; some are grandfathers, their fathers yet living, and some are great grandfathers before they be married."

Next to the fear of plague, that of a scarcity of fuel seems greatly to have occupied public attention. The increasing population, and a long period of peace, had made much wood land be taken into cultivation; and the effect of this, independently of the increased demand, was permanently to diminish the supply of firewood and of timber for building purposes. Hence the earnestness of writers on husbandry to provide against a dearth of wood, by planting the poor and waste lands of the country; for, although firing had not risen, like timber, greatly in value, but had long continued steady in price, it was admitted by all that the woods were rapidly decreasing.

Standish is loud in his blame of those who fell but forget to plant. A scarcity of wood, in his opinion, being, among other things, "a great decay to tillage, and cannot but be the greatest cause of the dearthe of corne, and hindereth greatlie the yearly breeding of many cattell by reason that much straw is yearly burned, that to the breeding of cattell might be employed; for the want of woode in many places in this kingdome constraineth the foyll of cattell to be burned, which should be employed to the strengthening of land; and the want of woode causeth many great losses by fire, that commeth by the burning of straw, and so it may be conceived *no woode no kingdome;* for sea coales there is no assurance how long they may endure. It is apparent that coal mines doe decay too fast in most countries, and are too chargeable to other countries in respect of carriage."*

* Commons Complaint, p. 2, 7. He gives an estimate of the profit to be derived from planting. Timber trees growing to 80 years, he

The same facts are stated by Moryson, who observes, that "England abounds with sea cole on the sea coast, and pit coal within land; but the woods at this day (1613) are rather frequent and pleasaunt than vaste, being exhausted for fier, and with iron milles, so as the quantity of woode and charcoale for fier is much diminished in respect of the old abundance; and in some places, as in the fennes, they burne turffe and the very dung of cowes; yet, in the meantime, England exports great quantity of sea coale to forraine partes."* And Burton says, "that Leicestershire is almost all champain, and yeeldeth great delight and profit every way, and therein may compare with any shire adjacent; but heere is the onely maime it hath, the want of woode and fuell for fire, for which the inhabitants are constrained either to travel farre to fetch it, or else to make use of those small helpes which they have, as strawe, cowsherne, and such like."†

The open fires that are the chief means in England for diffusing artificial heat, are altogether inapplicable in countries where the winter is more severe, and the fuel not so abundant. The northern Germans burn their fuel in stoves or enclosed fireplaces, from which, as they have learned by experience, they receive a much greater amount of warmth, than if it were consumed on a hearth. Moryson notices the invention, and his description of the atmosphere of a German room, in 1613, will form a fitting companion to the account given by Erasmus a century before, of the air pervading an English parlour.

values at 20 shillings a tree, every tree therefore produceth 3 pence a year; so that, at 2 trees only on an acre the "summe ariseth to £1,120,000 yearly that will be made by planting waste lands for timber. Firewood of a thousand trees well husbanded he estimates at 12 pence a tree at every ten years' end, and the ground improved £10 an acre. Elm abounded every way about London in 1611."—Ibid. p. 31.

* Travels, p. 147.

† Description of Leicestershire, p. 2.

"The intemperatenesse of colde, he says, pressinge great part of Germanie, instead of fier (open fires) they use hot stoves for remedie thereof, which are certaine chambers or roomes having an earthen oven caste into them, which may be heated with a little quantity of wood, so as it will make them hot who come out of the colde, and incline them to sweatinge if they come near the oven; and, as well to keepe out cold as to retaine the heat, they keepe the doores and windows closely shut, so as they using not only to receive gentlemen into these stoves, but even permit rammish clownes to stande by the oven till their wet clothes be dried and themselves sweate; yea to endure their little children to set upon their stooles within this close and hot stove, (let the reader pardon my rude speeche as I bore with the bad smell); it must needes bee that these ill smells, never purged by the admitting of any freshe aire, should dull the braine, and almost the spirits, of those who frequent the stoves. When myself first entered into one of them, this unwonted heat did so wind about my leggs as if a snake had twined itself about them, and made my head dull and heavy; but, after I had used them, custom became another nature, for I never enjoyed my healthe in any place better than there."*

But to return to England and open fires, the Londoners are found complaining that the use of sea coal is destroying the healthiness of the capital. On the morning, in June, that Richard III. seized and beheaded Lord Hastings, he greatly lauded the strawberries that grew in the Bishop of Ely's garden, in Holborn, and begged his reverence, who was sitting at the council table, to send him a dish of them for dinner. In Parkinson's time, the garden of Ely House was still surrounded by green fields open to

* Travels, p. 77.

the country; and the increase of houses had been so trifling in any of the suburbs as could hardly injure even gardens in the city, yet to coal smoke he attributes a noxious influence over them. "Having showed you," says this ancient florist, "the best place where this, your garden, shoulde bee, let me likewise advise you where it should not bee. It shoulde not bee neere any common laystalles, or common sewers, or els neere any greate brewhouse or dye-house, or any other place where there is much smoke, whether it bee of strawe, woode, or especially of sea coles, which of all others is the worst, as our citie of London can give proofe sufficient, wherein neither herbe, nor tree, will long prosper, nor hath done ever since the use of sea coles began to be frequent therein."*

The injunctions and prohibitions of Queen Elizabeth, that were so often unheeded by builders in her lifetime, do not appear to have been better observed in the reign of her successor. In a proclamation issued by James I., in 1619, the same encroachments and nuisances are enumerated, that were attempted to be checked and removed by the Queen. A clause in the king's proclamation prohibits houses being built with stories overhanging each other, and directs that walls in future shall be built straight from foundation to parapet. A regulation, that, could it have been enforced, may be considered the most practicable step that had yet been taken towards permanent improvement. A commission was issued to Lord Arundel, Inigo Jones, and others, to carry the proclamation into effect; but, from succeeding measures, it may be inferred that it was abortive.

Louis Savot,† in 1624, observes that large rooms

* Paradisi in Sole, p. 2.

† Louis Savot, a native of Saulieu, in Burgundy, lived in Paris, where he practised the art of medicine. Being unsuccessful in a competition for the degree of doctor, he retired from the pro-

only were ever free of smoke, and that when fires were made in small apartments, a door or a window had invariably to be left open; otherwise air to supply the fire flowed down the wide flue, and brought the smoke along with it into the room. To amend this defect, he directed the hearth to be raised about 4 inches, the mantel to be lowered so as to make the opening of the fireplace about 3 feet high. The width between the jambs to be reduced to 3 feet; the jambs from the mantel to be carried up sloping to the waist, or where the flue begins to be of uniform width; and the opening of the fireplace to be formed like an arch. If proper attention be paid to these directions, there will not in any case be occasion to use the oelipiles of Vitruvius, the vent-holes of Cardan, Jean Bernard's smoke wheels, the chimney-pots of Serlio, or the contrivances of Delorme and Paduanus, all of which may serve on occasion to cure one flue, but, in the greater number of cases, they have a most injurious effect on the adjacent chimneys.

In cases where it was not convenient to alter the fireplace, Savot perforated, with small holes, a plate of iron, that in width and length was nearly equal to the hearth, and this he fixed at a distance of 3 inches from the tiles that formed the common hearth. On this perforated plate he placed a "grill de fer" made as long as the billets that were to be burned, and raised it 9 inches above the plate. He laid the wood on the grate, the charcoal on the perforated plate, and the hearth received the ashes from both. The air rising through the small holes made the charcoal burn like a wind furnace, which so assisted the combustion of

fession and applied himself to other pursuits. He was the author of several works of merit. Le Médicine Charitable he composed for the use of the poor. His treatise on Architecture was much esteemed for the sensible observations it contained on construction, and on the choice and value of the materials used in building.

the billets on the grate, that the fuliginous vapour was carried up the flue with great rapidity.

FIG. XXXI.

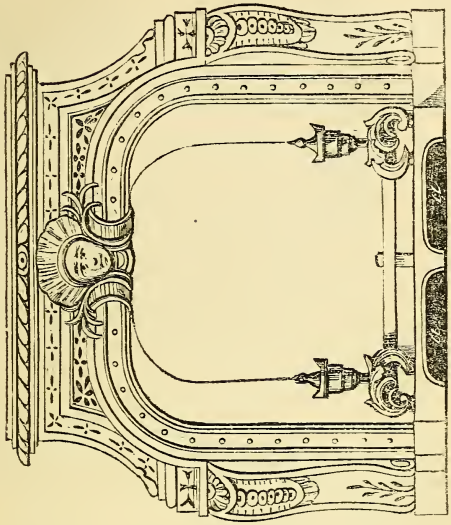
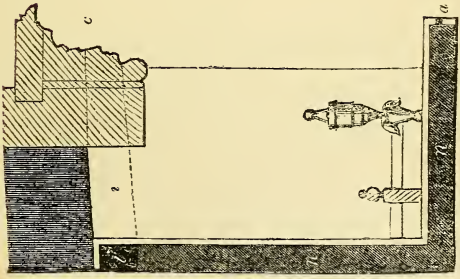


FIG. XXXII.



Savot describes another fireplace that has great

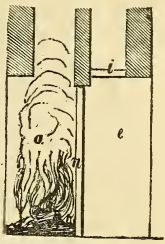
merit. A front view of it from his description is given in Fig. XXXI., and Fig. XXXII. is a vertical section of it. The hearth was made of a thick plate of iron placed above the old hearth, and leaving an interval, *n*, of 3 inches between them. The two sides or covings of the fireplace were also formed of thick iron plates placed 3 inches from the jambs. The space at the back, *n*, and spaces at the sides communicated with the space, *n*, under the hearth. Two pipes or channels, *i*, communicating with these hollow spaces, opened into the room at *c*, as shown by the dotted line in the section (Fig. XXXII.). They were formed to be closed at pleasure. When the brands were burning on the iron hearth it became very hot, and so also did the plates forming the sides or covings, and the back. The cold air at the floor entering by the openings at *a*, into the interval, *n*, came in contact with the hot hearth, and rising into the spaces at the back and sides received a further accession of heat; it then entered the channels, *i*, and flowed into the room at *c*, through which it speedily diffused an agreeable temperature.

Here, then, is the first attempt at combining the cheerfulness of the open fire with the economical effect of an enclosed stove; and the Louvre-grate will be recognised as the model of a host of contrivances that have been invented and re-invented since its appearance; and, without undervaluing later apparatus, it may be said to be a more perfect fireplace for burning wood, than any of its modern imitations. Savot does not claim to be its inventor. He merely describes it as the apparatus that heated the "Cabinet des Livres" at the Louvre. The principal chamber de la Pompe at Paris was heated by another.*

* Architecture Françoise, p. 159.

Another very economical way of heating a cabinet or wardrobe, when it adjoins a chimney in which there is no fire, is noticed by Savot; all that is required being to form of a plate of iron the separation between the fireplaces of two adjacent rooms. A fire made on the hearth, *a*, heats the plate, and this in its turn warms the air in the adjacent room, *e*, as well as a stove, provided its flue, *i*, is properly closed. By the same simple means a small room that has no chimney may be comfortably heated by making an opening in the wall, at the back of the fireplace, and closing it with an iron plate.*

FIG. XXXIII.



From the generally defective construction of English fireplaces, smoke could seldom be excluded from the room; and to free the sea coal from the sulphureous element that made its vapour so obnoxious, was a popular project when Sir John Hacket and Octavius de Strada, in 1626, obtained a patent for converting coal into coke, in order to make it as pleasant a fuel for chambers as wood or charcoal.† The speculation

* L'Architecture Françoise, p. 162.

† Rymer. Fœdera, vol. xviii. p. 870.—The application of coal and peat to several processes heretofore performed with wood, is the subject of some patents at this period. In 1627, Astell, Copley and Crofts had one for the "Arte and way of melting iron oare, and for making the same into cast work and barrs with sea coal and pytt coal." Rymer. Fœd. vol. xviii. p. 992.—In 1630, Ball, Lassel, Hampton, and Audley, prepared "peat or turf, by reducing it into a coal so that it shall serve for the making, melting, and fineing of iron." Ibid. vol. xix. p. 189. And the Earl of Berks, in 1637, had a patent for a kiln to dry hops and malt with sea coal. Ibid. vol. xx. p. 191. "The *use* of turf was *first* made known in France, in 1621, by Charles de Lamberville, advocate of the parliament of Paris, who resided sometime in Holland, to which he had been sent by the king, on public business." Beckman. Hist. of Invent. vol. i. p. 337. As the city of Paris had consumed all the wood in its neighbourhood, and as the price of that article became enormous, on account of the distance of forests, and the expense of transporting it, "John Rouvel, a citizen and merchant, in 1549, fell upon the plan of conducting wood, bound together, along rivers which were not navigable for

was, however, soon after abandoned, the vapour of coke being found as deleterious as that from pit coal.

The plague that Howell says broke out in the same house, in Whitechapel, in which it originated twenty-two years before,* being rife in London, the attention of the court was drawn, in 1625, to the condition of the streets and houses. Charles I. taking into his consideration "the present estate of the cittie as being the king's chamber, and the seate ymperiall of this kingdome, and renowned over all partes of the Christian world," endeavoured to stop, by proclamation, some practices that greatly aggravated, if they did not occasion, the public calamity:† but with no better success than had attended the edicts of his predecessors.‡ In 1631, another proclamation was issued for the regulation of buildings. No house in future was to be erected with rooms in whole stories less than 10 feet between floor and ceiling, and their windows were to be made higher than they were wide for the benefit of ventilation; and, with the same intention, the rooms in half stories were not to be less than 7 feet 6 inches from floor to ceiling, and their windows were to be made as wide as they were high.

large vessels. With this view, he made choice of the forests in the woody district of Morvant, and as several small streams and rivulets had their sources there, he endeavoured to convey into them as much water as possible. This great undertaking, at first laughed at, was completed by his successor, Réné Arnoul, in 1566. By this method large quantities of timber are conveyed to the capital, from Nivernois, Burgundy, and Franche Comté. The French consider the transportation of large floats, *trains de bois*, a great invention; but Beckman is of opinion that this method was known and employed in Germany at a much earlier period.—Ibid. vol. ii. p. 323.

* Familiar Letters, p. 158.

† Extraordinary ignorance of the nature of infection, or culpable indifference to the means for checking its effects, were manifested by all classes. One instance may be taken among many. "After the fleet returned from the expedition against Cadiz, in 1626, it was laid to the charge of the admiral, Lord Wimbledon, an officer of great nautical experience, that when Lord Delaware's ship was infected, he gave orders that the sick men should be *scattered* into divers ships, which so dispersed the contagion, that great numbers of men (upwards of a thousand) died before the fleet reached England."—Howell. Familiar Letters, p. 169.

‡ Rymer. Fœdera, vol. xix. p. 181.

These enactments of manifest advantage to public comfort were accompanied with all the prohibitions contained in the proclamations of Elizabeth and James, with regard to the distance at which houses were to be erected from the city, to their being built of stone and brick, and covered with tiles or lead. The new buildings erected on old foundations were not to be subdivided into more dwellings than they had been for thirty years before, nor was a different use to be made of them. Cottages and sheds, and encroachments of all sorts on the streets, were to be forthwith pulled down. For three years no housekeeper was to receive into his house more than one lodger, undersitter, or family; where there were more than one lodger they were to be summarily ejected. A commission was again appointed to carry the objects of the edict into execution, and it was charged specially "to report what *cellars* were used for lodging and victualling places."

In 1634, Captain Thorneff Frank received a patent for the construction of furnaces, that, according to the statements of those who used them, reduced the consumption of fuel almost two thirds, and as a matter of course, when compared with those on the common construction, emitted very little smoke. In what the improvement consisted the record does not state—but that the captain's method saved fuel, and above all diminished the intolerable nuisance of smoke, is certain; for the king issued a proclamation to "draw the attention of his loving subjects to such an acceptable invention," and vouching for its efficacy, recommended its general adoption.*

* Rymer. Fœdera, vol. xix. p. 181, 564.

Price of fuel in February, 1633. A sack of 4 bushels of the best old charcoals, 14 pence; a sack of the middle sort of charcoals, 10 pence; smallest sort, 8 pence. A sack of 4 bushels best and largest small coals, 6 pence; 1000 best Kentish billets, true assize at waterside, 16 shillings; 1000 best Essex billets, 18 shillings; 1000 best

The painted cloths and tapestry, that Perlin observed in such profusion in English houses, had been generally obtained from France or Flanders, where the manufacture had been naturalised, and carried on with the consummate taste and skill acquired by the experience of many centuries. The art was not, however, unknown in England. According to Dugdale, in the time of Henry VIII., a Mr. Shelton brought over some tapestry weavers from the Low Countries, and succeeded in making tapestry, for which it is said Hans Holbein furnished the designs. The success of this enterprise is not known. The next notice we have of the art is in the reign of James I. This prince was a munificent patron of Sir Francis Crane, who formed an establishment for weaving hangings at Mortlake, near London; and Charles I. also gave a most generous encouragement to the same meritorious individual. The hangings fabricated at Mortlake were admired in foreign countries for their texture and beauty. The civil wars, it is said, eventually ruined this manufacture; but failure must ultimately have followed from other causes. The taste for this description of wall hangings was rapidly declining. A better manner of finishing the interior of houses made tapestry, as a screen, less necessary; and the use of framed paintings, as decorations on walls, made scenic drapery an unsuitable lining. The high price of arras, even of the most ordinary kind, and the general improvement of taste, that had outrun, at least in the commoner varieties, the improvement of the manufacture, were all un-

western billets, 14 shillings; 100 best Kentish faggots, true assize at water side, 7 shillings; 100 best Essex ditto, 6 shillings; the best western were the same price. Rymer. Fœdera, vol. xix. p. 513. At this time the vintners were prevented from selling *faggots*, that they hitherto had dealt in. When Noy, the attorney general, died in 1635, they drank carouses in the hopes of again having this trade restored to them, which, by a sudden caprice, he restrained them from.—Howell. Fam. Letters, p. 240.

favourable to the ultimate success of the establishment at Mortlake.

Woollen damask, and a fabric composed of a woollen ground and silk figures, had long been employed as a substitute for tapestry and silk linings; but this was expensive. Stamped and painted leather, a modern invention, was so much improved in taste and workmanship, that they were employed as wall hangings in apartments where splendour even was studied; and when ornamented with small stars, leaves, sprigs, grotesque animals, heraldic devices, or mottoes in gold, on clear bright blue, green, and crimson grounds, they were much coveted for their elegance. For a considerable period after its introduction, in the time of Henry VIII., this leather tapestry was obtained from Flanders; but it was now manufactured at home, in a style superior to the foreign production. Its expense, however, confined its use to the display rooms of the noble and wealthy. A common kind, with the pattern in Dutch gold, or coarsely painted, and of a much lower price, was used to decorate the rooms in tradesmen's houses; but both the best and ordinary sorts were ill-adapted to line damp or mouldy walls, that were very common in the times under notice. Woollen and linen cloths were likewise painted to imitate tapestry, damask, and painted leather; they, too, had been procured from abroad, and, from their comparatively low price, were generally seen in the parlours and best bedrooms of common houses. Wainscot also was much used, even to the exclusion of tapestry, in apartments aspiring to the utmost magnificence. It was moulded, carved, and gilt, and often covered not only the walls but the ceilings. There was no question as to its durability; it was also reckoned, though not with good reason, the best lining for damp walls; and to make good the preference, and yet disguise the effect of moisture on

the lining, the carpenters of those days were wont to fill up the space, between the wainscot and the wall, with wool, or with charcoal and other substances. Next to tapestry, wainscot was the most costly finishing. In Norway, oak; it cost from six to seven shillings a square yard, exclusive of an extra charge for mouldings or carvings. All these linings greatly promoted the warmth of the apartment, particularly those of arras or damask, which were either suspended or strained a few inches distant from the wall; and the wainscot, with its wool and charcoal backing, was unexceptionable.

An invention, however, for which Jerome Lanyer received a patent, in 1634, was at no very distant period to supersede the methods that have been described for decorating the walls of domestic apartments. His contrivance, that he called Londindriana,* consisted in painting woollen, or linen, or cotton cloth, or other substances, with a viscous oil, or size, and while the surface so painted was moist, covering it with wool, reduced by cutting and grinding to the state of powder. This wool powder, adhering to the painted, clammy surface, produced the appearance of fine cloth. After this had dried it is obvious that any pattern might be printed or painted with the same viscous medium on the prepared woollen surface, and this pattern being covered with the wool dust, would appear in relief in any colour that was desired. Lanyer's first attempt, it is said, was directed to affix silk on some prepared ground, but that did not succeed. Though he seems not have confined himself to leather or cloth, there is no mention of his having used paper."† Yet the probability is that he employed this material. This most elegant fabric was cheaper

* Rymer. Fœdera, vol. xix. p. 556.
† Beckman. Hist. of Inventions, vol. ii. p. 164.

than the commonest leather tapestry, and was as comfortable a wall lining as tapestry or damask.

Sir Robert Mansel, with the assistance of some Venetian workmen, had about this time succeeded in his project of manufacturing glass with pit coal; and in 1635, the importation of foreign glass was prohibited in favour of Sir Robert's material, though the public complained that it was much inferior in quality to what came from abroad, and higher priced. It, however, had become as much a necessary of life as it is at the present day.*

The great concern shown by Charles for the preservation of public health was not quite disinterested. Many of the practices that were deemed to require public correction were so inveterate, that perhaps at this time they appeared to him capable of being made a not unpopular part of his ways and means, since he had to carry on the business of government without the assistance of parliament. The heavy fines, however, that he extorted from those "mechanical persons who had been the occasion of the deformitie in building," and who had disobeyed the proclamations of King James, from thinking that they were "no law, because beyond law," did not improve either the houses or the streets, but, on the contrary, as far as the public was concerned, they injured both, through the permanency given to the encroachment and the nuisance

* To break the windows "from the inside" was a distinguished way of exhibiting resentment. When Charles I. dismissed the foreign attendants on the Queen, the sudden, undreamed-of order struck them all with astonishment, and they ran to complain to their royal mistress, but Charles had taken her into his bed-chamber, and locked the door upon them, until he had told her how matters stood. The queen fell into a violent passion, tore her hair, and broke the glass windows; she was then calmed.—Howell. Familiar Letters, p. 240. When Ben Jonson was lying sick in bed, after much importunity of courtiers, the king sent him ten pounds. The distressed poet was so indignant at the unking-like amount of the benefaction, that he chucked the money "through the glasse windows, saying this man's soule was not fit to live in an alley."—Nonesuch-Charles, his Character, p. 91.

by payment of fine, or commutation for the transgression.*

The growth of London, that was considered an evil by Elizabeth and James, may have appeared in the same light to his successor. Hence their attempts to discourage in every way the erection of houses, and to limit the number of inmates in order to prevent an increase of inhabitants. And hence also, from this policy, the appalling amount of mortality produced among the poor, who were driven, by invincible necessity, to inhabit crowded, damp, ill-ventilated apartments. After the dire experience gained from many visitations of the plague, a due and humane consideration of the wants of the most helpless portion of the community, would assuredly have prompted a strict limitation of the number of persons inhabiting one room or house; and had that been accompanied with encouragement to build in the suburbs, under such architectural regulations, with regard to width of streets, height of rooms, size of openings, means for draining, heating, and venti-

* Sir William Davenant's picture of London, as ludicrous as true, will be a good commentary on the proclamation. "Your ancestors contrived your narrow streets in the days of wheelbarrows, before those greater engines, carts, were invented. Is your climate so hot that you need umbrellas of tiles to intercept the sun; or your shambles so empty that you are afraid to take in the fresh air lest it should sharpen your stomach? Oh! the goodly landscape of old Fish Street, where the garrets, not perhaps, for want of architecture, but for abundance of amity, are so made that opposite neighbours may shake hands without stirring from home. Your old houses have more ovals, niches, and angles, than are in your custards, and are enclosed with pasteboard walls, so slight and so prettily gaudy, that if they could move they would pass for pageants. The ceilings are so low that I presume your ancestors were very mannerly, and stood bare to their wives, for I cannot discern how they could wear their high-crowned hats. Your beds seem no bigger than coffins, and your curtains so short, that they may be held if taffeta to have lined your grandfather's shirts." Whittaker does not give a more favourable view of provincial houses. "All the timber houses that I have seen are wretchedly dark and comfortless within. The high, narrow windows, the diamond quarrels, the stone floors, together with the absence of shutters and curtains, afford but a melancholy picture of the dwellings of thriving manufacturers in the time of Charles I.—Loidis and Elmete, p. 79.

lation, as would have prevented the new erections from becoming in their turn a focus of disease, like the old houses in the city, the privation and pestilence that grievously bore down the cotemporary poor, would have been comparatively unknown, and all classes in after times would have been essentially benefited. To the evils of over-crowding and foul air, another was added, in 1634, by the imposition of a duty of four shillings a chaldron on coals brought by sea into London. This impolitic measure, and galling addition to the current amount of the poor man's suffering, justified, perhaps, the bitter reproach afterwards thrown on its ostensible author, when the plague, in 1636, swept off upwards of twenty-three thousand inhabitants,* that his tax had greatly increased the mortality, from the privations inflicted on the poor by the high price of fuel in the winter.

In the unsettled period that succeeded, the Londoners were several times subjected to great privations from the scarcity of firing. When Newcastle was held for King Charles, in 1644, the supply of coal to the capital was stopped, and they rose to four pounds a chaldron; parliament attempted to provide turf and peat to meet the exigency, but these being inadequate to the demand, great distress ensued among the inhabitants. One complaint ceased during this dearth of fuel. The brewhouses and dyehouses being either altogether idle, or using comparatively little fuel, the air of London became most salubrious, and "divers gardens and orchards planted," says Evelyn, "in the very heart of London, as in particular my lord marquesse of Hertford's in the Strand, my lord Bridgewater's, and some others about Barbican, were observed to bear such plentiful and infinite quantities of fruits,

* Collection of scarce Pieces, p. 80.

as they never produced either the like before or since. It was, by the owners, rightly imputed to the penury of coales, and the little smoake, which they took notice to infest them that yeare." *

The want of fuel was also felt severely in 1646, and the lord mayor, in a proclamation, promises those who out of their good affection and *charity* to the city, shall adventure to bring sea coal, or any other manner of fuel into London for the benefit of the inhabitants, especially for the use of the poor and needy, who, heretofore were yearly provided from Newcastle, "shall be accounted men well affected to the city, and their actions taken as very acceptable service, and not to be forgotten."

The dearth of coal continuing, although considerable supplies were received from Newcastle, in 1648, many persons were starved to death.

In this state of things the indoor comfort of great multitudes must have been at a low ebb, and the state of the streets was not calculated to improve it. Howell, in 1648, alludes to the air of Grand Cairo, when the wind is southward, and wafted from spice-bearing countries, being as "sweet as a perfumed Spanish glove. The air of London is not so, especially in the heart of it, in and about St. Paul's Church, where horse dung is a yard deep, insomuch, says he, that to cleanse it would be as hard a task as it was for Hercules to cleanse the Augean stable by drawing a great river through it." †

Sir Hugh Platt, whose scheme for coal balls has been noticed in a previous Essay, was one of the most ardent florists and gardeners of his day. In a treatise

* Fumifugium, p. 21. Evelyn says that the inhabitants in parts of France, south-west of England, formerly complained of being infested with smoakes drawn from our maritime coasts, which injured the vines in flower. Ibid. p. 38.

† Familiar Letters, p. 420.

on these subjects, that he printed in 1652, he threw out a hint that a temperate heat might be given to a conservatory at a small charge by means of steam. His apparatus is simple enough. A pipe is fastened to the cover of a pot that is kept seething over some idle fire,* and by this pipe steam may be conveyed from the pot into the conservatory.

Some nuisances being brought under the notice of the Lord Protector, in 1657, a long discussion took place in parliament, on a clause in a bill then before the house, to remove the brick kilns five miles from London. The citizens who complained of the nuisance of smoke, and of the erection of cottages in the suburbs, as encroachments on their airing ground, were by a manœuvre violently opposed to the salutary measure. In the committee, the Speaker was zealous in its favour. A member observed that the citizens were not sensible of what was for their own good, for the smell of the kilns was a great nuisance; on which other members remarked, that they had consulted physicians on the subject: and one of the committee went so far as to affirm, "that it was a wholesome smell of brick kilns." On the question being put that "the house doth agree with the committee in the clause touching the making of lime or brick within five miles of London," it passed in the negative.†

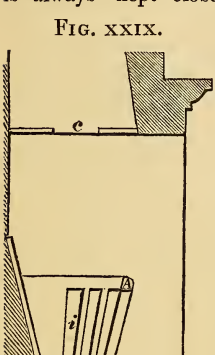
In the year following, Sir John Winter, cousin to the celebrated Marquis of Worcester, the inventor of the steam-engine, revived Strada's project to chark sea-coal, in order to make it a pleasant fuel for domestic purposes. Considering the time, the fireplace he invented to burn the coke in has some pretensions to ingenuity, and will be recognised as an

* Garden of Eden, p. 50.
† Burton's Diary, vol. ii. p. 221.

imitation of one of the schemes recommended by Savot.

The cradle or "fire-cage" of the usual form is placed on a box about 11 inches high, in the front of which is an opening, *o*, fitted with a door, that is always kept closed, except when withdrawing the ashes that fall from the grating of the fire-cage. A pipe, *a*, inserted into the side of the box, communicates with the external air at a level of 2 or 3 feet below the bottom bars of the fire-cage. This pipe or channel near the place of its insertion, into the side of the box, has a small door or trap that can be adjusted at pleasure to admit the external air into the box, or wholly to exclude it.

FIG. XXIX.



When the charked coal in the fire-cage burned deadly, the stop was placed so as to let the wind from the outside enter the box freely, and the fire on the instant was blown up as if by a powerful bellows. By turning the stop in the windpipe, the blast could be discontinued, when the fire was sufficiently lighted.* The flue was closed with an iron plate, or register, that moved on a hinge. It had an opening 8 inches square, for the emission of the smoke, which Sir John found was large enough for the greatest fire-place. In 1658, he sent some of his charked fuel, "with his new-

* In Italy at this period, Ray says that the palaces of the Italian noblemen are rather great and stately than commodious for habitation. In many cities the *paper windows* which are for the most part *tattered* and *broken*, being unsuitable to their magnificence."—Journey, p. 397.

fashioned grate, to several great men, for a trial, but it came to nought."*

At this period Ray found the houses of the common people in the country and villages in the south of Scotland to be pitiful cots, built of stone, and covered with turves, having but one room, many of them had no chimneys, and the windows were very small *holes*, not glazed.† At Douglas there was scarce a house that could keep a man dry in a shower of rain; in the principal towns the fronts of the houses were made with fir boards, nailed one over another, in which were round holes or windows to put out their heads. In the best houses, even in the king's palace, the windows were not glazed throughout, but the upper part only. The lower half had two wooden shuts or folds, to open at pleasure, and admit the fresh air. The noble and the very wealthy had tapestry and damask, and wainscot linings, though less costly perhaps than what were seen in the houses of persons of the same rank in England. The gentry hung their best rooms with damask, or with painted leather, ornamented with grotesque animals, flowers, and mottoes, stamped in gold or in dutchfoil. In the houses of the small gentry and stationary "merchants," the chamber of dais, that was always reserved for occasions of ceremony, was lined with this leather tapestry, or with a thin woollen stuff, woven in the country. This was also the hanging for the gudeman's bed-room, particularly if an 'effeminate' townsman. Finishing the walls and ceilings with plaster and stucco was, although known, rarely used. In the most stately and fashionable houses in great towns, they ceiled the chambers with fir boards, nailed on the under side of the joists. The furniture was scanty, chests and presses (or wardrobes), with a

* Whitelock's Memorials, p. 674.
† Itinerary, p. 189.

chair or two, and stools, low tables, and, in the best houses, window-curtains, and cushions on the bunkers or window-seats, were reckoned necessary.

A chimley or grate for burning coal or peat, standing in a large hearth recess, under a flue of enormous width, was usually seen in the "best room," with "very small bright tangs and poker and shool hanging by nails on the wall." Bellows were very rare. The room had sometimes a boarded floor, well sanded, and in country houses, sprinkled with the leaves of the fir-tree; carpets were luxuries of the high-born. Beds, inclosed with boarded partitions, carried up to the ceiling, were very often placed at the two corners of the kitchen, and also in the gentleman's chamber of dais or dining-room, where space was to be economized. They had the appearance of a large cupboard, inclosed with two sliding doors. Their warmth as sleeping-places was more considered perhaps than the feeling of their being musty. In 1661 it was the manner, Ray tells us, in some places, to lie on one sheet only, as large as two, turned up from the feet upwards. Warming-pans were as rare as bellows. At that period also, according to the same authority, the house-wives were not very cleanly, and he thought the men were lazy, because he saw them ploughing with their plaids on. They however paid laudable attention to their portable climate; and the worthy patriarch of English botanists observes, with a spice of spleen, moreover, that "they lay out the most they are worth in clothes; and a fellow that hath scarce ten groats beside to help himself with, you will see him come out of his smoky cottage clad like a gentleman."

ESSAY VIII.

The failure of the measure to remove the brick kilns was regretted by the public, who now felt the necessity for some legislative regulation. It is amazing, Evelyn remarks, that where there is so great an affluence of all things, the sordid and accursed avarice of some few particular persons should be suffered to prejudice the health and felicity of so many, for empoisoning the air was ever esteemed no less fatal than poisoning water, or meat itself. London is built upon a sweet and most agreeable eminency of ground, on the north side of a goodly and well-conditioned river, towards which it has an aspect by a gentle and easy declivity, apt to be improved to all that can render her palaces, buildings, and avenues useful, graceful, and most magnificent; that its buildings, therefore, should be composed of such a congestion of misshapen and extravagant houses, that the streets should be narrow and uncommodious in the very centre and busiest places of intercourse, that there should so ill and uneasy a form of paving under foot, so troublesome and malicious a disposure of spouts and gutters overhead, are particulars of reproof and reformation, because it is hereby rendered a labyrinth in its particular passages, and a continual wet day after the storm is over. But that this glorious and ancient city, which commands the proud ocean to the farthest antipodes, should wrap her

stately head in clouds of smoke and sulphur, I deplore, says Evelyn, with just indignation. What darkens all her other attributes except that hellish and dismal cloud of sea coal, which is not only perpetually over our head, but mixed with the otherwise wholesome and excellent air; and that not from culinary fires, which being weak and less often fed below, is easily dispersed; but from some few funnels belonging only to brewers, dyers, lime-burners, and soap-boilers, one of whose *spiracles* alone does manifestly infect the air more than all the chimneys of London put together. Whilst these are belching from their sooty jaws, the city of London resembles the face rather of Mount Etna, or the suburbs of hell, than an assemblage of rational creatures, and the imperial seat of our incomparable monarch. These foul mouthed issues, and curls of smoke, do draw a sable curtain over heaven. The columns and clouds belched forth are so thick and plentiful, and rushing out with great impetuosity, they are capable of resisting the fiercest winds, and fall down upon the houses before they can be dissipated, so as two or three of these fumid vortices are able to whirl it about the whole city, rendering it in a few moments like the picture of Troy sacked by the Greeks, or the approaches of Mount Hecla. When the air in all other places is serene and pure, it is here eclipsed with such a cloud of sulphur that the sun itself, which gives day to all the world beside, is hardly able to penetrate and impart it to London, and the weary traveller at many miles distance sooner smells than sees the city to which he repairs. It is that pernicious smoke which superinduces a sooty crust or fur upon all that it touches, spoiling the moveables, tarnishing the plate, gilding and furniture, and corroding the very iron bars, and stones. It is this horrid smoke which obscures our churches,

and makes our palaces look old. How it sticks on the hands, and faces, and linen of our fair ladies and nicer dames who reside constantly in London, especially during winter, the prodigious waste of almond powder for the one, and soap and wearing out the other, do sufficiently manifest. It scatters and strews about those black and smutty atoms upon all things where it comes, insinuating itself into our very secret cabinets and most precious repositories, which diffuses and spreads a yellowness upon our choicest pictures and hangings, is avernus to fowl, and kills our bees and flowers, abroad suffering nothing to bud, display themselves, or ripen. The air of London is never clear of this smoke, which is a plague so many other ways, and indeed intolerable, because it kills not all at once, but always; for is there under heaven such coughing and snuffing as in the London churches and assemblies of people, where the barking and spitting is most incessant and unfortunate; and what may be the cause but the inspiration of this infernal vapour?

Evelyn gave some special cases. "The presumptuous smoke" from two funnels near Whitehall, filled the rooms and galleries of the palace, so that persons could hardly discover one another for the cloud. The incomparable monarch was annoyed with it, and it hurt the breast and lungs of his sister the Duchess of Orleans. It so indisposed a merchant when he came to the Exchange for an hour or two, that he was always forced to take horse, and ride for his life until he came to the fields, on his way home again. Some of Evelyn's country-friends, "who were studious of music," as often as they came to London used to lose three whole notes in the compass of their voices: and he says, that Old Parr, who lived to the age of 150 years, in the pure air of the country, was not so much injured with the change of diet, as some have affirmed,

as with the difference in the air, which plainly withered him, and spoiled his digestion soon after his arrival. In fact, those who repaired to London, no sooner entered it than they found an universal alteration in their bodies, which were dried up; their humours were made apt to putrify; their perspiration was stopped; they lost their appetite, and experienced a kind of general stupefaction.

Evelyn's complaint is not more lugubrious than the occasion warranted. In his day the combustion of fuel was not understood, and coals were cheap. Of the 200,000 tons imported,* when he wrote, a large proportion was burned, or rather dissipated in furnaces constructed with huge fireplaces, gaping flues, and above all with chimney shafts, seldom carried more than a few feet above the roof of the brewhouse, or dyehouse. Many had no spiracles at all, and Frank's invention, whatever it was, appears to have been forgotten. Modern experience of the nuisance of furnaces formed with the greatest skill, will at once convince us that two or three fuliginous vortices, such as Evelyn describes, were sufficient to pollute the air of a large district, and poison a community.†

The work of purification Evelyn proposed should begin by removing every manufactory that required large fires to the district between Greenwich and Woolwich, and by preventing similar buildings being erected near the city in future. Churches and

* McCulloch Dict. of Commerce, p. 293.

† So late as 1772 it was observed that since Evelyn's time there had been a great increase of glass houses, founderies, sugar bakers, to add to the black catalogue of brewers, dyers, and soap boilers, at the head of which must be placed the steam engine spiracles of two water works, "which, whilst they are working, leave the astonished spectator at a loss to determine whether they do not tend to poison and destroy more of the inhabitants by their smoke and stench than they supply with their water. Trades who make use of large fires should carry their chimnies higher than they do. Many of these buildings have no chimnies, and appear constructed to beat other smoke downwards."—Fumifugium, p. 4.

churchyards were to be discontinued as places of sepulture. Tallow melting, butchering, soap-boiling, and all such offensive operations were not to be carried on within the city, except in a certain situation. When these preliminary steps had been taken, which at the time were practicable, and had been suggested by others, this benevolent projector told the king that he would render not only his palace one of the sweetest, and most delicious habitations in the world, but also that every breeze should waft such an odour into the streets of the city that all would feel as if by a certain charm, or innocent magic, they were transferred to that part of Arabia styled the happy, because it is amongst the gums and precious spices. Those, he says, will agree with what he suggests, who have inhaled the scent of the orange trees from the rivage of Genoa, or the blossoms of the rosemary from the coast of Spain, or the manifest and odoriferous wafts which flow from Fontenay and Vaugirard, even to Paris in the season of roses, with the contrary effects of those less pleasing smells from other accidents.*

The way that he purposed to enable the king and his good citizens to breathe an air like that of paradise, was to form the stagnant, marshy, ague-breeding environs into a garden like that of Eden.

All the low grounds around the city, especially on the east and south west, were to be laid out in fields of from twenty to forty acres, separated from each other by fences or hedges enclosing a plantation of a hundred and fifty, or more feet deep round each field.

* These are described by Howel. "The streets of Paris," he says, "are generally foul all seasons of the year; some of the suburbs seated high, the filth runs down the channel, and settles in many places within the body of the city, which lies in a flat; and 'tis such a dirt that by perpetual motion, is beaten into such a thick black unctuous oil, that where it sticks no art can wash it off, the *crot* is indelible; besides the stink this dirt leaves, it gives so strong a scent that it may be smelt many miles off, if the wind be in one's face as he comes from the fresh air of the country."—Familiar Letters, p. 21.

These hedges were to be planted with such shrubs as bear the most fragrant flowers, and that are aptest to yield their fragrance to the gentlest breeze. Such as the "sweet brier, all the periclymenas, and woodbinds, the white and yellow jessamine, both the syryngas or pipe trees, the guelder rose, the musk, and all the other roses, genista hyspanica: to these may be added, the rubus odoratus, bayes, juniper, lignum vitæ, lavender, but above all rosemary, the flowers whereof give their scent above thirty leagues off at sea. At some distance towards the meadow side, vines, yea hops,

Et arbuta passim,
Et glaucas salices casiamque crocumque rubentem,
Et pinguem tiliam et ferrugineos hyacinthos,

for there is a very sweet smelling sally (willow), and the blossoms of the tilia or lime tree are incomparably fragrant; in brief, whatsoever is odoriferous and refreshing."

The areas between these fragrance-emitting fences were to be planted with beds and borders of "pinks, carnations, clove, stock gillyflower, primroses, auriculas, violets, not forgetting the whole which are in flower twice a year, cowslips, lilies, narcissus, strawberries, whose leaves as well as fruit emit a cardiaque and most refreshing halitus; also parietaria lutea musk, lemmon, and mastic thyme, spike, cammomile, balm, marjoram, pimpernel, and serpillum, which, upon the least pressure and cutting breathe out and betray their ravishing odours."

"The fields and crofts within these environing gardens were to be planted, some of them with wild thyme, others with beans, and pease, and blossom bearing grain that send out their virtue at the farthest distance, by which means the air and winds perpetually fanned from so many circling and encompass-

ing hedges, and fragrant shrubs, trees and flowers (the prunings of whose superfluities may in winter, on some occasions be burned to visit the city with a more benign smoke) not only all that did approach the region which is properly designed to be flowery, but even the whole city would be sensible of the sweet and ravishing varieties of the perfumes, as well as of the most delightful objects, and places of recreation for the inhabitants."*

Should a smile be excited at the gravity with which he advocates the counteraction of the incorrigible London smells by fragrance of flowers, it should be borne in mind that the scheme, visionary as it must *now* appear, was the foible of an amiable and most accomplished man, whose enthusiasm for gardening and planting has been of inestimable benefit to the kingdom by creating a taste for rural improvements and plantations that adorn the country, and are useful to the community.

His project, however, at the time it was propounded, had apparently the effect of stirring up a spirit in high quarters, to carry some of its recommendations into effect. During a sailing match on the Thames between Charles II. and the Duke of York, Evelyn was on board the king's boat. "In which passage," he says, "the king was pleased to discourse with me about my book, inveighing against the nuisance of the smoke of London, and proposing expedients, how by removing those particulars that I mentioned, it might be reformed, commanding me to prepare a bill against the next session of parliament, being, as he said, resolved to have something done in it."†

Three months afterwards (1662) he notices in his Diary, that "he received of Sir Peter Ball, ye Queen's Attorney-General, a draught of an act against the

* Fumifugium, p. 49.
† Evelyn's Memoirs, vol. 1, p. 339.

nuisance of the smoke of London, to be reformed by the removal of the several trades which are the cause of it, and endanger the health of the king and his people."* It was to have been offered to the parliament as his majesty commanded, but nothing was done in it. From which it is probable that Charles' patronage was given to the project more with a view to gratify the patriotic wishes of one who had been a warm adherent to him in his exile, and most instrumental in his restoration, than to recommend the measure with a resolution to have it carried into execution. Evelyn's scheme was carried into effect in one instance only. The lime trees in St. James's Park were planted, it is said, from his suggestion.

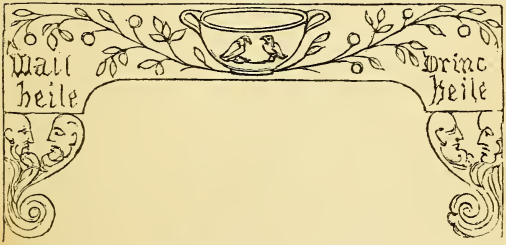
Among the Londoners who were obliged to breathe the contaminated atmosphere, and to bear the misery of cold rooms, a number of antidotes were in constant use against the noxious effects of both. That propounded by Stevenson was, perhaps, most generally followed, as one of the most pleasant, if not the most efficacious. In the month of June, according to this experienced adviser, coals, and other necessary fuel, are to be brought home, as in August they will begin to make towards the chimney. "In December," he continues, "I hold it a needlesse thing to prescribe, for I presume frost and snow will convince thee that a freeze jacket will do you more service than a taffeta doublet. I therefore give thee, gentle reader, the same advice that I meane to practise myself; that is, now and then, in snow and frosty weather, to thawe your congealed veynes, and cherish them with a glass or two of rich and rasie wines, which are chiefly chosen by the five F.'s—*fortia fragrantia formosa frigida frisca*."† But when the key of the wine cellar was

* Evelyn's Memoirs, vol. 1, p. 345.
† The Twelve Moneths, p. 3.

mislaid, or the binns empty, a most potent preservative against bad air, and cold, was found in a home-made medicine, thus recommended a century before by the truly orthodox and pious Bishop Still :—

" Thoughe I go bare take ye no care,
I am nothinge a colde;
I stuffe my skyn so full within,
Of joly goode ale and olde.
No frost, nor snowe, no winde I trowe
Can hurte me if I wolde,
I am so wrapt and throwly lapte
Of joly goode ale and olde."*

The mansion house called Groves, at Berlen, was built by a Lord of the Manor, in the olden time, who has left a record of his good-fellowhood on the large oaken carved beam that supports the chimney piece.



The capacious vessel in the centre is the old wassail bowl, the delight of his ancestors, (and of himself,) who never failed on the vigil of the new year to assemble their cheerful neighbours round the glowing hearth; and then, from innate goodness of heart, to drown in the spicy wassail-bowl every former animosity—an example worthy of universal imitation. The two birds

* Gammer Gurton's Needle, p. 14, edit. 1818.

formed a rebus of the builder's name; and the apple branches supporting the bowl, may either typify that they drank good cyder at their wassailings, or that the roasted apple was not forgotten in the composition of the inspiring beverage. *Drinc heile*, and *wass heile*, the usual friendly and affectionate quaffing phrases among our jovial forefathers, were placed here in order that when the guests turned to the fire, they might read the words coming warm, as it were, from the heart of the hospitable entertainer. The carved brackets are an elegant termination to this interesting composition.*

The mottos on chimney pieces were not considered merely as ornaments; morality, and rules of life, were taught by them. The wise and worthy provost of Eton, says,—"Always, if we touch any tender matter, let us remember his motto that wrote upon the mantel of his chimney, where he used to keep a good fire, Optimus secretariorum."†

* Antiquarian Repert. vol. iii. p. 156.

† Reliquiæ Wottonianæ, p. 363.

We will here collect a few notices of the art of fireside divination.

"When our common fires do burn with a pale flame they presage foul weather. If the fire do make a buzzing noise, it is a sign of tempest near at hand. When the fire sparkleth very much, it is a sign of rain. When the pots are newly taken off the fire, if they sparkle, the soot upon them being incensed, it presages rain. If the ashes of the hearth do clodder together of themselves, it is a sign of rain. When the fire scorcheth and burneth more vehemently than it useth to do, it is a sign of frosty weather. But if the living coals do shine brighter than commonly at other times, expect then rain. When wood or any other fuel do crackle and break forth wind more than ordinary, it is an evident sign of some tempestuous weather near at hand. The much and sudden falling of soot presages rain."—Ramsey, Elminthologia, p. 271, says, "if salt or the fire falls out towards a person, then expect anger." Goldsmith, in his Vicar of Wakefield, among other omens favourable to the hero's daughter, tells us, "purses bounded from the fire." In the north of England, cinders that bound from the fire are carefully examined by old women and children, and according to their respective forms are called *purses* or *coffins*, and consequently are thought to be presages of death or wealth. "A coal," says Grose, "in the shape of a coffin, flying out of the fire to any particular person, betokens their death not far off." The purses are, by others, also classed into empty or full. If round shaped, they are well plenished; if somewhat coffin shaped, they have but little

A very ingenious adaptation of one of Mr. Boyle's speculations, was proposed by Dr. Henshaw, in 1664.

in them; if in cooling the purse-shaped coal crackles very much, then it presages a real purse filled with "chinking gold pieces." In the Secret Memoirs of Mr. Duncan Campbell, p. 61, De Foe makes the fire afford another kind of divination to these omen-mongers. They see swords, guns, castles, churches, prisons, coffins, wedding wrings, bags of money, men and women, or whatever they either wish or fear, plainly deciphered in the glowing coal. Cowper, in his Task, says:—

"Me oft has fancy ludicrous and wild,
Soothed with a waking dream of houses, towers,
Trees, churches, and strange visages expressed
In the red cinders; while with poring eye
I gazed, myself creating what I saw.
Nor less amused have I quiescent marked
The sooty films that play upon the bars;
Pendulous, and foreboding; in the view
Of superstition, prophesying still,
Though still deceived, some stranger's near approach.
'Tis thus the understanding takes repose
In indolent vacuity of thought."

Some persons exclaim against their want of thought, if, through haste or forgetfulness, they have chanced to hold a letter before the fire to dry. The Irish, when they put out a candle, say, "May the Lord renew or send us the light of heaven."—Gentleman's Magazine, 1795; Brand's Popular Antiquities by Ellis, vol. iii. p. 504.

A flake of soot, says Grose, hanging at the bars of the grate, denotes the visit of a stranger from that part of the country nearest the object. Girls, another says, will clap their hands near the pendulous flake, and according to the number of claps required to disengage it from the grate bar, so many days will it be before the "expected" makes his appearance. If, during clapping, the flake be ignited in any part, then the "expected" is "very ardent indeed" in his passion, and if it be blown into the fire again, then his soul "is in flames." Sometimes no number of claps will disentangle the provoking flake, and it adheres tenaciously to the grate bar; in that case the "expected" stranger will not be "worth much" as a beau. When the fire burneth at one corner of the grate, it is a sign that the persons present when it is observed, will be separated from each other shortly.

To *dream* of fire is very bad indeed. If two young persons, who "keep each other company," are seen in a dream standing before a fire, the one who first moves will infallibly turn out "a great deceiver." If either pokes the fire, he or she will die before they can go to church. Should the fair one touch the poker, she will be too confiding, and make a fool of herself. To dream of fire generally is a certain presage of being put into a violent passion in the course of the day. "When a seer," says Martin, "in his novitiate, sees a vision in the night-time, without doors, and comes near a fire, he presently falls into a swoon; and if in his vision he sees a spark of fire fall on one's arms or breast, it is the forerunner of a dead child being in the arms of that person shortly."—Martin. Description of the Western Islands, p. 30. 1716.

In some places the kitchen fire is preserved with as much care as was that of the vestals. In Wales or Scotland, if it should happen by any means to be quite extinguished, it was reckoned a very unpropitious omen, and to presage death. In Scotland, the old women

The doctor thought it probable, that the air alters and changes the tone and temper of the humours of

considered, if a spark was left sufficient to light a *spunk*, the sickness would be "doure," but not mortal. A kitchen fire has been known not to be extinguished for 65 years, and when that event took place, "the wise people" noticed that the laird's nephew died eleven months afterwards. Only one other instance was known, by the gossips, to have occurred in the same house, and that was in 1746, when the family left home to avoid a visit from a detachment of soldiers belonging to Prince Edward's army, that was expected to march that way. The Highlandmen, according to ingle tradition, extinguished it by very unceremonious means on purpose to bring "ill luck" on the fugitives. The fire that was lighted in due form by the laird himself on his return next morning was burning in 1810. It was reckoned singularly unlucky, and as such most unneighbourly, to beg a light from any one on New Year's day. To beg it accidentally from one with whom we were not on the most friendly terms, was still more unpropitious, and held to be an injury inflicted with malice aforethought; but to receive the light from a "plain-soled" person, was so broad a hint of the beggar's time being come, that he was in duty bound to make his will. Bellows, about forty years ago, might now and then be found, in gentlemen's houses, but in the country they may be said to have been unknown. And had the fire been put out no one had any means to renew it, except by borrowing a lighted peat or coal from a neighbour's fire. In many districts a tinder-box was unknown. *Spunks* (sulphur matches) were rarely used. The gun-lock was made a tinder-box, by placing a little tow under the powder, burned as priming.

In the Western Islands they knew how to strike a light with a flint and steel, but they were ignorant of the way to form this simple apparatus. A tax, Martin tells us, which they called the *fire penny*, was paid by each family to one of the natives, for the use of his steel and flint as often as they kindled a fire in any of the lesser isles. This impost was very advantageous to the proprietor, but very hard upon the commonwealth, who could not be furnished with fire on these occasions in any other way. I showed them, says Martin, that the crystal growing on their rocks would yield fire if struck with the back of a knife, which to them was as profitable as it was a surprising discovery, since it enabled every man in the isle to light a fire when he pleased; but it was a serious misfortune to the Prometheus of St. Kilda, who lost his tax by it.

They, however, produced flame on certain occasions by the attrition of two pieces of wood. This fire the inhabitants of North Uist called *Tin-egin*, *i. e.*, a "forced fire," or the "fire of necessity." When it was to be produced, all the fires in the island were extinguished, and then eighty-one married men, that being the number and qualification thought necessary for effecting the charm, took two great planks of wood, and nine of the men, who were employed by turns, by their repeated efforts rubbed one of the planks against the other until the friction ignited the wood. From this fire of necessity, each family was supplied with *new* fire, which was no sooner kindled than a pot with water was quickly set on it, and afterwards sprinkled on the people infected with the plague, or upon the cattle having the murrain; and the islanders affirmed, from their experience, this to be an effectual remedy.—Martin. Description of the Western Islands, p. 293.

Roberts, in his History of Lyme Regis, states, that witches en-

human bodies, especially on their quitting one clime for another. But however salutary the change of air may be, for the cure of any infirmity, it suits the convenience of but few whose health would be restored by the removal, to leave their families, or business. Besides, physicians seldom advise their patients to go abroad, until they have employed in vain many remedies to cure them, whereby the chance of recovery is commonly lost, and the sick person deprived of the benefit he would otherwise have received, by a more timely removal into a favourable climate; whence it happens, that so noble a remedy is not only neglected, but brought into disesteem, for want of more frequent examples of its singular efficacy in the treatment of many diseases.

Now, continues the Doctor, I will show the manner of a contrivance, by which any person may receive the benefit of a removal to another climate, at any season of the year, without removing from his own house, or neglecting any employment whatever. A convenient room, of twelve or fourteen feet square, or any other size, is to be well ceiled, and boarded or paved, that the air may not have any vent, either to escape or to enter through the joints or crevices. The walls of brick or stone, are to be well plastered on the inside; and the windows so contrived that no air shall pass in or out of them that way, and that they may be the stronger, and not liable to crack, they are to be of moderate size. The door, likewise, is to be made that it may shut into its frame so exactly as when closed to be air tight. The chamber and its openings being thus prepared, a very large pair of organ bellows is to be placed in some convenient part of the room; their nosel is to be exactly

tered the houses by the chimney, and that the only way to prevent their visits was to suspend in the flue a piece of bacon stuck all over with pins.

joined to a copper pipe, whose other end passes through the wall of the room, and is furnished with two valves; one valve opening outward, which may be placed in water, the other valve opening inward, and both valves are to be so contrived that either of them may be open or shut while the other is in action. The bellows being thus fitted, the door and windows shut close, and the room throughout made air-tight, it may be filled with what quantity of condensed air is desired, or as much air may be discharged from the room as will bring what remains to the required tenuity. If the air is to be exhausted from the room, the bellows must be placed with their moveable part upwards, and the innermost valve of the copper pipe must be kept constantly open. But, if the air is to be forced into the chamber, and condensed, the bellows are to be placed with the under leaf upwards, and the outward opening valve of the brass pipe is to be kept open. Working gently with the bellows in this way, the room may be either charged with air, or discharged of it; and, consequently, the air it contains may be of whatever tenuity or density is required. That there may be no mistake of the degree in which either effect is produced, a barometer is to be fixed in the apartment.*

The particular application of this domicilium, or air chamber, will depend on the nature of the disorder for which a patient desires to use it. A person labouring under a chronic disease being placed in the chamber, the air is forced out, or exhausted by degrees, as long as the patient continues to feel his breathing to be easy; or, at least, not in any way rendered more difficult. He is now to note the height of the mercury in the weather glass, which will show him to what degree he may attenuate the air the next time

* Aerochalinos, p. 86.

he uses the domicilium without danger of cramping, which sometimes ensues, when the air is much rarefied.

On the other hand, if the disease be acute, then it is necessary that the chamber be charged with air of that degree of density that shall seem convenient; taking care that no difficulty of breathing ensues, which oftener happens when inhaling condensed than attenuated air.

The time of continuing in the domicilium, must be regulated in each particular case by the medical attendant,—generally two or three hours in the morning, will be sufficient in chronical cases; but in acute diseases, perhaps, the patient may remain in the chamber during the whole course of the disease, and in intermittent fevers, especially, the whole course of the paroxysms must be spent in the domicilium, the air being rarefied in the cold fit and condensed in the hot fit. In malign diseases, where an amendment of the insensible perspiration is to be desired, the air is to be rarefied, not condensed. By the use of the domicilium, the usual amount of insensible perspiration may be doubled.

In time of health this domicilium is proposed as a good expedient to help digestion—to promote insensible perspiration—to facilitate breathing and expectoration, and consequently of excellent use for the prevention of most affections of the lungs, and whatever benefit a change of air produces in diseases may reasonably be expected from the use of this domicile. By means of it, the patient may provide for himself such air as were not otherwise to be found but on the Peak of Teneriffe, or some other very high mountain; nay, he may rarefy the air to a far higher degree, and make it such as he could nowhere find upon the face of the habitable world. It may also be used for preventing the inconvenience that is often

experienced from the sudden change of air by a person travelling into foreign countries; by reducing the tone of the air of any climate to that of his own country. With the addition of a chair or bed, hung after the manner of a sea-compass, the domicilium might also be employed on board a ship, to prevent sea-sickness. And on the same principle, Henshaw thought great vessels might be constructed to receive whole thighs and arms, and, after the manner of cupping-glasses, discharge such humours as have seated themselves in particular parts, besides very fitly supplying the place of the strongest ligatures.* The medical benefits of the domicilium must be left to be estimated by practitioners of the healing art, but the novelty of the thought, and mechanical ingenuity displayed in its development is of a high order. The inventor, however, as if aware of uncandid objections, modestly requests that his scheme may not be hastily judged, nor its novelty create a prejudice against it.

* Aerochalinos, p. 98. Dublin, 1664.

When Dr. Hales, in 1741, published his scheme to sweeten the air of ships, he was told that his project resembled Henshaw's. "How wide is their difference; my ventilators," says Hales, "are intended to promote a free perspiration and breathing, by conveying great quantities of fresh air into ships in exchange for very bad air. On the contrary, Dr. Henshaw's contrivance would make a good air, by confining it, very bad, and thereby retard perspiration and incommode the breathing, and so cause, instead of preventing sickness."—Description of Ventilators, p. 19.

The Doctor could not see merit in a rival project. M. Junot, who seems to have carried Henshaw's project into practice, without, perhaps, knowing that it had been suggested 150 years before, thus speaks of its effects. "When a person is plunged in condensed air, he breathes with a new facility, he feels as if the capacity of his lungs was enlarged; his respirations become ample and less frequent; at the end of fifteen minutes he experiences an agreeable warmth in his chest, as if the pulmonary cellules, long strangers to the contact of air, were dilated anew to receive the genial spirit, while the whole animal economy sucks in at each inspiration a fresh supply of life and vigour. The arterial system acts with increased force, the functions of the brain are excited, the imagination becomes lively, and the thoughts are accompanied with 'a peculiar charm.' The movements of the muscular system are more energetic and digestion becomes more active, but without thirst." In *rarefied* air, the effects are nearly reversed.—Ure. Architectural Magazine, vol. iv. p. 180.

Those medical writers who have given an account of the plague, observe, that two persons died of it in December, 1664 : and that the winter was remarkable for a severe frost, which continued until the middle of March, when a sudden thaw leaving the ground covered with water, and great heats succeeding, the inhabitants of many districts lived, as it were, in a room flooded with water, in which there was a great fire. It is easy to imagine some effects this winter and spring would produce on a population living in cellars and rooms crowded with inmates, stifling in their own steams for months, and suffering much privation from cold; for during this long winter there had been a great dearth of firing—their clothes, bedding, and furniture, must have been encrusted with the concrete animal exhalations, and their bodies weakened by inhaling an impure atmosphere.

The prevalence of breezy weather during the spring months, seems to have retarded the development of the incipient infection. Although the mortality of other diseases was high when compared with former years, yet until the middle of June not one had died of the plague in the ninety-seven parishes of London —only one case had occurred in Southwark, and the eastern suburbs were quite free from it. As the summer commenced, the warm season was anticipated with apprehension; all who could, left the city, and the Court removed to Oxford. The weather now set in very hot, and the air was loaded with moisture. Maitland, in his History of London, mentions that there was an uninterrupted *calm* for several weeks, so that there was not air sufficient to turn a vane; and Baynard, a contemporary physician, makes a similar statement.*

* In times of plague and other pestilence, the vicinity of smelting furnaces was formerly resorted to, as being least liable to the infectious visitation. The sulphureous and acid fumes were doubtless

The havoc of desolation now began. The contagion which had been confined for many months to individuals, seized families, and neighbourhoods. The wave of pestilence spread over streets and districts, and was moving irresistibly to engulph the entire city. In three parishes thousands were buried in a week.* The citizens, struck with dismay and terror, held the opinion that the death was in the air. The streets were swept daily; the dust removed; laystalls in the city were not used; all corrupting animal and vegetable matters were carefully taken away; domestic animals were forbidden to be retained or suffered to go loose within the city; pieces of artillery were fired, and detonating substances exploded, to disinfect the atmosphere; and the houses were fumigated with resinous woods, and perfumes. They sprinkled their garments with acids; and carried aromatics in the nose and mouth. The large bonfires that were made in the streets, to clear the air, after burning for three days, were accidentally extinguished by the fall of some copious showers; when, as if to show the utter nothingness of the means resorted to for checking its ravages, the pestilence increased; and this was marked as the most direful day of that period of calamity—four thousand persons expired during the night.† Fifty thousand bodies were thrown from the dead-carts into the horrible pits, during the months of August and September; and upwards of a hundred thousand citizens perished in all. The number that was seized is un-

the disinfectants. It seems not impossible that the freedom which London enjoys from the spread of malignant diseases, may in part be ascribed to the products of the combustion of coal which always taint its atmosphere. The drainage and copious supply of water contribute, however, essentially to the health of the inhabitants; for the effluvia from the offal of large cities, if not speedily and effectively carried off, is productive of infinite mischief.—Brande, Manual of Chemistry, p. 1135.

* Hodges. Loimologia, p. 16.

† Quincy. Essay on Cause of Contagion, p. 28.

known. But when the disease began to decrease, and its symptoms to be milder, sixty thousand persons were infected, of whom twenty thousand died. The greater proportion of this appalling mortality fell, as might have been expected, on the indigent, who lived in the ill-aired quarters of the city. Lord Clarendon relates, that he left London with the Court, when it removed to Oxford; and at his return he missed very few of his acquaintances who remained behind, the sufferers having been chiefly the lowest sort of people, who lived in circumstances of great filth, and in foul air.

Medical writers, who have treated of this visitation, observe that as the plague had existed more or less in London every year for some period, and on the present occasion had unquestionably been manifested for several months without spreading, it is clear that the mere presence of contagion was not sufficient to render it epidemical. They further observe that effluvia emanating from dead corrupted animal matter, even in a state of putrefaction, does not produce fever of an infectious type. And, that when these exhalations seem to engender such a disease, they consist in part, or are mixed with, the vitiated effluvia from the *living human body*. And it seems to be an invariable result, that the accumulation and stagnation of the breath and perspiration of human beings crowded for a period in confined air, and neglecting personal cleanliness, produce plague or fever that may be communicated to healthy persons by contact or respiration.*

* The chemical nature of infectious and contagious matters is quite unknown, except in so far as they appear to possess the general characters of organic compounds, and are decomposed and resolved into harmless products by certain chemical agents, among which are heat, chlorine, and a few of the gaseous acids. Clothing infected with contagious matter is disinfected by exposure to a temperature of 220° F., when subjected to a current of air. *Washing* in soap and water, *boiling*, and *steaming*, are equally effective. Chlorine

In England the plague never became epidemical before the beginning of July, and it reached its height in September, after which it declined. It required air of a temperature between 60° and 80° F., and charged with moisture, to develope its infectious action. Hence when the want of ventilation in the houses concurred with the moist, warm, calm air out of doors, or, in other words, with the want of wind, the great ventilator of nature, every squalid inmate of an ill-ventilated apartment became a reeking sphere of pestilence impregnating the motionless air of his dwelling and neighbourhood with the fatal elements of a loathsome death. One cannot contemplate without astonishment the delusive and futile means that were followed to avert and mitigate the dire contagion, nor think without humiliation that *opinions* prevented reliance on the promptings of nature, to keep themselves clean, and to admit fresh air into their habitations: the only rational and effectual means of escape from danger, and by following which modern physicians not only prevent infection and make it harmless, but have eradicated the epidemical plague itself from England.

A despicable disregard to decency still, however, continued, and not one step was taken after the plague

is the most effective *fumigating* agent. One of the most remarkable properties of some forms of infectious matter is its permanency, retaining, as is frequently the case, its peculiar powers for an indefinite period. The infection of *scarlet fever* is sometimes retained for weeks and months by articles of apparel. In one instance, after a malignant form of that disease had prevailed in a house, it was fumigated with chlorine and white-washed, and every article of furniture and clothing cleaned and fumigated, with the exception of a handkerchief that had been overlooked, and to which the reappearance of the disease, after a period of two months, was probably attributable. Blankets and woollen goods seem specially *retentive* of such poisons, and in all doubtful cases should be burned. Of the influence and production of *malaria*, of *marsh miasmata*, and other poisonous exhalations of organic but principally of vegetable origin, we are equally ignorant: they chiefly produce that extraordinary disease, the *ague* or *intermittent fever*, and their nature is obscure and unintelligible.—Brande. Manual of Chemistry, p. 1135.

ceased, to prevent its recurrence, or any municipal regulation made to prevent the accumulation of domestic impurity in future.

The great fire that happened in the following year, by destroying the numerous focuses of infection in a large district, did more in three days to advance the progress of comfort and public health, than could have been accomplished by precept, or the horrors of plague, in a hundred years. It imposed the necessity of erecting new buildings in large masses, the sanatory effect of which would have been comparatively lost had they been built at distant intervals. The neighbourhoods were new and clean. The domestic conveniences in the internal arrangement of the houses, introduced by Jones and others, were generally followed; the rooms were more lofty and capacious; the ups and downs that distinguished the passages to rooms in the late houses, and the hide and seek closets were discarded, and the staircases were generally lighted. The ground floors were boarded, cellars were no longer reckoned as lodging-rooms, and every room had its chimney.

A general cleanliness and freshness gave a new notion of existence to the natives. They moved, says a local historian, in a large sphere of pure air, and, seeing and feeling every thing sweet and new around them, they perhaps wished to keep them so. Luxuries and improvements in furniture of all sorts were gradually introduced, and a man of moderate fortune saw his house superior in its fittings and comforts to the palatial rooms built in the time of his grandfather. When he paced the streets, according to the same authority, he felt the genial western breeze pass him rich with the perfume of the country, and, looking upward, he beheld the beautiful azure sky variegated with fleecy clouds in place of projecting beams,

black windows, stories, and spouts, obscured and blackened with smoke and dirt.

Still more substantial benefits were conferred upon him by the better ventilation of his house from its arrangement and openings. The plague disappeared; and other diseases produced or aggravated by the want of proper drains and pavement in the streets, also vanished for a period. Among these, one that committed great ravages among the Londoners, however strange it may sound to modern ears, to whom it is unknown, was the ague. In the year that Queen Mary died this fever was so rife and mortal, that, according to Dr. Caius, the most eminent physician of that time, the living could hardly bury the dead. And Bishop Burnet, in his History of the Reformation, says it raged like a plague. The capital was seldom free of it. James I. and Oliver Cromwell both died of agues contracted in London. In the time of the plague, and during four preceding years, it destroyed great numbers. Looking, therefore, to the improvement in the houses and streets, and to the consequent greater healthiness of the inhabitants, it was with a pardonable enthusiasm that Malcom exclaimed, "thank God, London was burned down! for filth in every house and in every street made infection eternal."

Fuel, in 1667, was scarcer and dearer than it had ever been before or since. The Dutch fleet infesting the coast, so completely interrupted the intercourse with the coal districts, that no ship could enter or leave the river. "On the 23d of June," Pepys tells us, "that the misery the city and kingdom is like to suffer for want of coal, it is feared will breed a mutiny; for we are not in any prospect to command the sea, for our colliers to come, but rather it is feared the Dutch may go and burn all our colliers at Newcastle." (A

strange fear this in a secretary to the Admiralty.) On the 24th of June, Evelyn was called before the Privy Council, and desired by the king to go with some others and search the environs of the city, now exceedingly distressed for want of fuel, and ascertain whether any peat or turf could be found that was fit for use. "Next day I went," says Evelyn, "and discovered enough, and made my report that there might be found a great deal; but nothing further was done in it."* . . . On the day after Evelyn made his report, Pepys again says in his Diary, "such is the want already of coal, and despair of having any supply, by reason of the enemy's being abroad, and no fleet of ours to secure the colliers, that coals have come this day, 26th June, to five pounds ten shillings per chaldron;"† very small quantities only could be had even at that enormous rate, and all brewing and manufacturing operations were at a stand, for the stock of wood and straw was also exhausted.‡

The preference for wood fires was much lessened by this and previous scarcities, for many who had heretofore excluded coal from their parlour hearths, "were fain to burn it now, and when wood got plenty again, they kept to coal, as giving less trouble, and more heat."

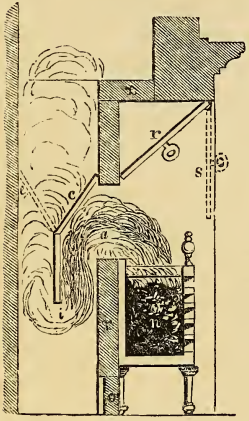
Jorevin de Rochford, who about this time visited London, found that more coal than wood was burned by its citizens, which caused many persons to assert, that here the streets and houses were all black with the smoke of coals, that, besides, emitted an unsupportable stench, whereas, says this most candid of travellers, the fact is quite the contrary, no fuel being less offensive in a chimney than coal, which being

* Memoirs, vol. i. p. 405.
† Pepys's Memoirs, p. 84.
‡ Observations on the Traffic in Coals, p. 17.

enclosed in a kind of iron cage, when once lighted, burns without requiring to be blowed, and yielding a greater warmth than wood.*

The next object of importance in the history of ingle comfort, is the fire-place that Prince Rupert had in his chamber about 1678, of which Fig. XXXIV. is a section, and Fig. XXXV. a plan. A wall, *a x*, is built at a distance of 10 inches from the back of the hearth recess, and carried up to the mantel, where it is terminated with a ceiling, *x*, that perfectly closes the communication between the flue and the room. In this wall is an opening, *a*, as wide as the length of the grate, *n*, and 10 inches high. Its sill is 2 inches above the "top rib" of the grate. Two walls are built at right angles to the front wall, and carried up to the same height, or as high as the waist of the flue where practicable. The space between each of these walls and the jambs of the hearth recess, is filled up, as shown on the ground plan, with bricks, or rubbish and mortar. The smoke tunnel *i*, is thus formed 10 inches from back to front, and as wide as the firegrate, and communicates with the room, by the opening *a*, in the front wall *x*.

FIG. XXXIV.

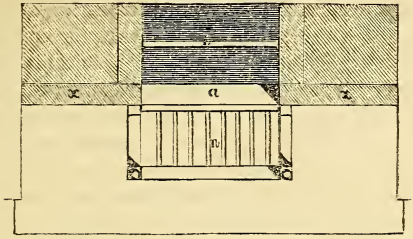


In this smoke funnel, a plate of iron *i*, nine inches or more in depth, a quarter of an inch in thickness, and 2 inches longer than the funnel is wide, is placed perpendicularly so as to divide the funnel equally in

* Antiquarian Repertory, vol. iv. p. 602.

two; its ends are inserted into the side walls of the tunnel, and its upper edge is placed about 2 inches above the level of the sill of the aperture *a* in the

FIG. XXXV.



front wall. An iron door, *c*, hinged on the upper edge of this plate, as shown in the section, is 10 inches broad, and as long as the smoke funnel is wide, and works easily backward and forward, and lies in the position shown at *c*, in Fig. XXXIV., or in that indicated by the dotted lines at *e*. The fuel grate stands on the hearth, and is placed nearly on a line with the wall of the room. In the figures, it is shown placed further back. *o*, a brick that closes the aperture through which the soot that falls on the floor of the funnel is removed.

The grate being filled with coals and "pimps," the smoke door *c*, is pushed back into the position shown by the dotted lines *e*, in the section. The pimp is then set fire to, and the smoke runs "cheerfully" through the opening *a*, into the funnel *i*, and thence into the flue. When the coals are thoroughly lighted and burn clear, the smoke door is then drawn forward into the position shown at *c*, in the section, Fig. XXXIV.

The smoke being thus hindered from flowing upwards, reverberates from the iron door; but the

draught created in the flue carries the smoke downward, and it passes the lower edge of the division plate *i*, and rises between it and the back of the hearth recess, into the flue of the chimney, and continues to do so, as long as there is any fire in the grate.

When fresh fuel is wanted, it is better to supply a little at a time, than all at once; for sometimes when a great quantity of damp raw sea-coal is thrown into the grate, especially in windy weather, the smoke beats back from the iron door, and comes puffing into the room. But if the fire be made up with charcoal, or charked coal, the vapour will at all times flow as kindly up the chimney, as if it met with no obstruction from the division plate.

Should the fireplace be contained in an upper room, or garret, where the flue is very wide, and not very long, and in boisterous weather the smoke cannot flow through the aperture *a*, even when using charcoal, another iron door shown at *r*, in Fig. XXXIV., is to be hung from the under edge of the mantel, and in front of the fireplace. It extends the whole width of the opening, and varies in depth according to circumstances, being always as broad as to reach within 2 inches of the upper bar of the firegrate, when hanging perpendicularly, as shown by the dotted lines *s*, in the section. When the smoke flows steadily through the aperture *a*, at the back of the firegrate, this iron door is fixed in the position it has in the figure at *r*; but when the smoke is driven into the room, the pin or catch that holds it back is taken out, and the door falls, and hangs perpendicularly, as shown by the dotted lines at *s*. When in this position, and the fire is clear and strong, the smoke will be forced into the flue during the most violent winds, and the room will be "warmer than it would be with a fire four times the size made in a common cradell." This fire-door may also be used, if smoke be feared, when fresh

fuel is put into the grate; and may then hang perpendicularly, until the coals burn clear; but in no case will it be found necessary, when a servant is handy in managing the smoke door *c* in the tunnel, and may at all times be omitted, and its place supplied, as occasion needs, by an ordinary fire-board, or "fire-cloth."

According to the account given by Mr. Bingham, a bricklayer who advertised his skill in constructing this most ingenious fireplace, and who built Prince Rupert's, no fear need be entertained of the smoke ever coming into the room, after the iron door *c* is placed to make it descend; for although the smoke "naturally rises upward to follow the draught, it will as naturally follow a draught that is downward, as may be seen in the stove-ovens of Germany, wherein it is made to go first up and then down in small chambers, many times before coming to the chimney." *

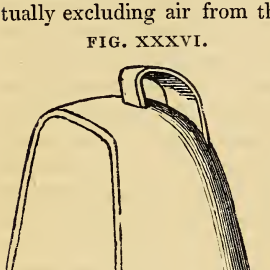
The fire-cloth that Mr. Bingham alludes to, was a common appendage to a fireplace, particularly where wood was burned, for then the flue was large, the hearth wide and low, and the mantel high; when the chimney smoked in certain winds only, the cloth was suspended, when wanted, from each corner of the mantelpiece. But when the disease was unremitting, the curtain was fixed by rings running on a rod that went across the fireplace; when not used, it was drawn to one side like the curtain of a cottage window; very often the fire-cloth was contrived to be drawn up like a modern Venetian blind, and made so deep as to reach from the mantel to the hearth, and serve the office of a fire-board when there was no fire in the yawning chimney. The first variety of smoke-cloth was seldom more than 15 inches deep, and was frequently made of painted leather; but in good houses the

* A New Fire-Place for Sea-Coale, p. 3.

suspended fire-cloths were usually of damask and tapestry. None of these contrivances are yet extinct.

Another implement always found in ancient houses, but for which the coal-burning moderns have no use, was the *curfew* or *couvre-feu*. When it was required to extinguish the fire, the embers were raked as close together as possible towards the back of the hearth recess, and the curfew was placed over them, with its open part set close to the chimney back, thus effectually excluding air from the fuel. The utensil in common cases was of iron, but many were of copper, covered with elegant enchased ornaments, which, from their beauty and taste, appear to have been fashioned abroad. The one in the cut was of copper, rivetted together, 10 inches high, 11 inches wide, and 9 inches deep.*

FIG. XXXVI.



An admirable heating contrivance was exhibited in 1680, at the fair of St. Germains, near Paris, in which the smoke not only descended, but from the construction of the stove was perfectly consumed. That knowing virtuoso, M. Justel, gave an account of this apparatus to the Royal Society in 1681. To burn all sorts of wood, he observes, in the middle of a room without making any smoke, is a thing so extraordinary, that all who have heard of it, as well philosophers as others, have asserted it to be impossible. M. Dalesme, prosecuting his discoveries, has nevertheless found out a machine, which though very little and portable, consumes the smoke of all

* Antiquarian Repertory, vol. i. p. 3.

sorts of wood whatsoever so completely, that the most curious eye cannot discover it in the room, nor the nicest nose smell it, although the fire be perfectly open. This, M. Justel goes on to say, has given satisfaction to all who have seen it, and King Louis himself caused the experiment to be repeated several times before him.

The engine is made somewhat after the manner represented in Fig. XXXVII., which is a longitudinal section, and in Fig. XXXVIII., which is a geometrical view of it. The apparatus shown in the figures is like that given by Leutman, a German, who described the contrivance, but it differs nothing from M. Justel's diagram, except in being somewhat more elegant. The whole is composed of hammered iron, and stands on the floor of the room. *c* is a vase which contains the fuel, whether wood or coal, having a grating fixed at *o*, on which it is laid. This vase is placed on a box, or cylinder, *o*, closed at both ends. From this box a pipe, *i*, is carried into a flue, that has no communication with the hearth recess nor with the air, except at the smoke ajutage above the roof.

FIG. XXXVII.

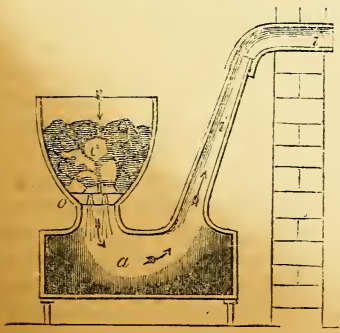


FIG. XXXVIII.

The vase is to be filled with charcoal or coal, and

some dry brushwood is laid above them. The upper part of the pipe *i* is now to be made very hot, by means of a lamp or hot iron; a current of air will thus be formed from the cylinder *o*, which flows downwards through the fuel in the vase *c*. In this state of the apparatus, a piece of lighted paper is laid above the wood that lies upon the coals in the vase; the downward current of air that has been produced through the fuel by heating the pipe *i*, carries the flame of the paper downwards also, and that ignites the wood below it, which communicates its heat to the coals placed on the grate *o*, and the flame and smoke thus carried into the cylinder *a* rise through the pipe *i* into the chimney, in the direction indicated by the small arrows shown on the section. This downward current is so perfect, that if one of the flaming pieces of wood be taken out of the vase, its smoke will rise upward with rapidity, but will cease immediately when it is thrown into the vase again, or rather its smoke and flame will be carried downwards. The *heat*, however, that *rises* from the vase is so intense that the hand cannot be held near it. "The most fœtid things," says Justel, "matters which stink abominably when taken out of the fire, in this engine make no ill scent, neither do red herrings broiled thereon. On the other hand all perfumes are lost, and incense makes no smell at all when burned therein."* The smoke and flame being forced downwards, and passing through the heap of burning coals in the furnace or vase *c*, become inoffensive both to the eye and to the nose.

The athanor or furnace of calcination used by the alchemists and later chemists, in which they made "soft and subtle fires of beechwood and coal," had the fireplace and ash pit enclosed by doors, as well as a small door for the "government of the wind, with a

* Philosophical Transactions, p. 78, 1681.

pipe having a third part of the diameter of the furnace to carry off the smoke, and the operators knew that by increasing the height of this pipe, the stronger would be the draught of the fire." According to Glauber, if in addition to the pipe from the top of the furnace, a long pipe having a register be put to the lower hole appointed for drawing wind, it will give to a melting fire the strongest heat, for by how much the air that feeds it is attracted the more remotely, the greater will be the power of the fire to melt the metal.

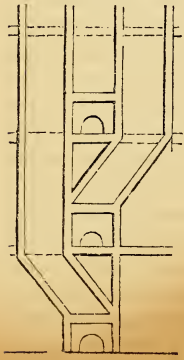
But where two chimneys adjoin, this long pipe may be dispensed with. "Thou mayst build a furnace," says Glauber, "in the superior chimney, and perforate the wall, that the fire may be forced to attract the air from *below* through the collateral chimney. A door or window in the lower chamber is to be opened to allow the wind to enter its chimney, that the fire may attract it, which it does very vehemently, yea, and stronger than if it were helped with bellows; wherefore a register is required for governing the fire."

Glauber, at the mention of whose name so many wry faces have been made for the last hundred and fifty years, made many himself before he hit upon this "blower," which he claims as his invention, and by the help of which he discovered his "salts." "From my youth," says he, "I underwent the trouble of vulgar labours performed by bellows and common vents, for I had spent many years of my life in superfluous watchings, as also in stinks, so that going into my elaboratory with loathing, I should behold so many materials in such various pots, boxes, and other vessels, and also as many broken as whole instruments of glass, iron, and copper, and did judge myself so unhappy that I had made myself a slave to the art, and especially because scarce one of a hundred, whereof I was one, did get his victuals and clothes thereby: for these reasons I

was determined to bid adieu to chemistry. But behold! whilst I thought to do as I had resolved, and to cast forth of the doors all vessels of divers kinds, I found some broken crucibles with many grains of gold formerly melted in them, which with others I gathered together. Wishing to melt such things, very hard to be melted without the help of bellows, which I had sold, I began to consider the matter with myself more seriously, and then I discovered this blower, which in trying I found so good that I again took hope of my labours, and would no more despair: and by its help I found out my choicest secrets, for which blessing I give to the immortal God immortal thanks."*

At the time when Savot described the Louvre fireplace, the common method of building chimneys in Paris, was to carry up the flues behind each other, with the projection into the apartment, and much trouble and expense were incurred in ornamenting these projections to conceal their deformity. At present (1685), however, says Blondel, all that expense is useless, for, since the *invention* of the method of carrying up the under flue by the side of the upper one, as in the figure, instead of behind it. the mantel is now made to project but a small distance into the apartment. At the commencement of this practice, it was imagined that the danger of fires originating in flues would in future be avoided, but it was found that their number, though much diminished, was still considerable, from want of

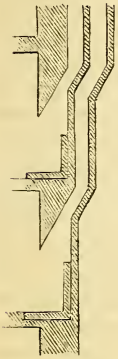
FIG. XXXIX.



* Philosophical Furnace, p. 68.

due precaution not to insert the ends of timbers in the flue walls, and not to form elbows and recesses in the tube, as was often done by careless or "malicious" builders,* although against the law.

FIG. XL.



At Venice, according to the same authority, they form their hearth recesses in the thickness of the walls, and carry the breast in a slanting direction from the mantel to the flue which is built on the outside of the wall. The flue of the lower fireplace is invariably placed outside of that on the floor above. The same architect tells us, that in Sweden they warm their houses by small round chimneys in the corner of the rooms, which have a small door that shuts up the opening of the flue. When green wood is burned on the hearth, this door or register is raised, and the smoke escapes up the chimney; but when the fuel ceases to smoke, the register is drawn down, and the carbonic vapour then spreads itself throughout the apartment, and heats it as effectually as a brazier, for which it may be added it is a clumsy substitute. A similar contrivance has been noticed at page 148, as in use in England. About 1685, small fireplaces for cabinets that were called "cheminées à l'Angloise" were introduced into Paris;† their hearth, back and jambs were formed of brass or iron plates; and it is probable that the same sort of hearth was to be found in England. They were not, however, very common, for in the fireplaces of great houses, the jambs and back, at this period, were most frequently of stone or tile. About the same period a small channel was sometimes constructed in the hearth, to open in front of the fuel, and was fitted

* Arch. Franc. p. 140. † Ibid. p. 142.

with a kind of trap or valve, which could be opened or shut; so as to direct the cold air on the fuel to promote combustion, and supersede the use of bellows.

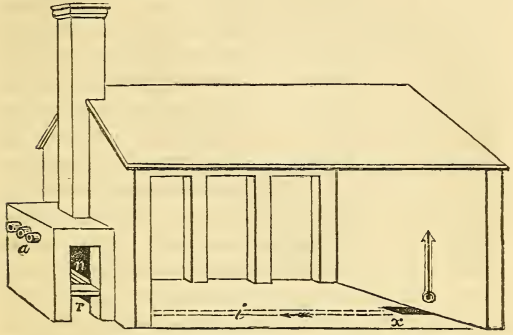
To the benevolent advocate for sweetening London by planting its suburbs with flowers and shrubs, we are indebted for a system of heating and ventilation of great merit and originality. Mr. Evelyn had observed, during many severe winters, that iron stoves and other inventions, such as subterranean caliducts, or brick flues, then newly introduced, were liable to many objections. Some tender plants outlived exposure to the air of houses heated by these means; but the hardiest among them very rarely passed their confinement without sickness, or a certain languor that was discovered by their parched leaves and loss of their natural healthy verdure, and which was occasioned through their not breathing that pure air, which is not only the nourishment and life of animals, but of all plants and vegetables whatsoever.

Whilst he could not but impute the weakness and diseases of delicate flowers to the consumption of that uninspiring dry heat emitted from the common stoves, pans of charcoal, and other included heaters which continually wasted and vitiated the stagnant pent up air, without any due and wholesome succession of the vital atmospheric element, it came into his thoughts, he says, that there might be found out some contrivance to remedy this inconvenience; and instead of imprisoned and effete air always occupying the greenhouse, there might be a constant stream of fresh and untainted aerial fluid let in and out freely, and so qualified in its composition as to make it very agreeable to the nature of plants that pass their hybernation in a conservatory.*

* Kalendarium Hortense, p. 170.

Fig. XLI. is a view of a conservatory, supposing one of its walls removed, to which Mr. Evelyn adapts his scheme for heating and ventilation; *n*, is the fuel grate; *r*, the ash pit, communicating with a flue, *i*,

FIG. XLI.



carried under the pavement to *x*, an opening in the floor of the conservatory; *a*, are earthen pipes, or caliducts, inserted into the side of the furnace, and carried through it into the conservatory.

FIG. XLII.

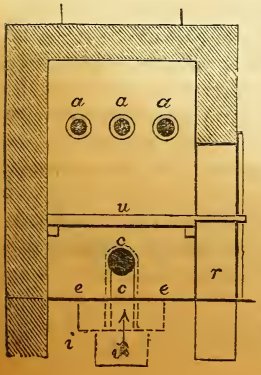


Fig. XLII., is a section taken longitudinally through the middle of the furnace; *e*, *e*, the ash pit; *c*, the end of a pipe or flue opening into it, which communicates by means of a pipe with the suction flue, *i*, under the floor of the conservatory; *r*, the door of the ash pit, to be made air-tight while there is any fire in the furnace; *a*, *a*, *a*, three earthen or iron caliducts carried through the furnace.

FIG. XLIII.

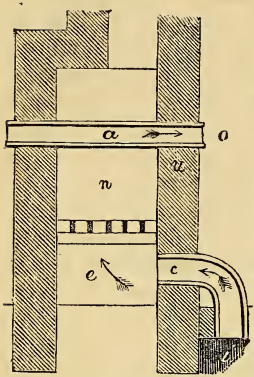


Fig. XLIII. is a transverse section of the furnace; *e*, the ash pit; *c*, the pipe that communicates with the suction flue *i*, in the floor, the air from which flows into the ash pit in the direction indicated by the arrows; *n*, the fuel chamber; *a*, one of the caliducts opening into the conservatory at the end, *o*. The external air is admitted into the chamber by these pipes, and flows in the direction indicated by the arrow. The ash pit is closed so as to be perfectly air-tight; and the suction flue in its whole length is to be air-tight also. It is to be observed, that the glazing of the windows, and the fitting of the sashes and doors, must be performed with great nicety, and the room made impervious to the admission of all air, except that entering by the caliducts in the furnace.

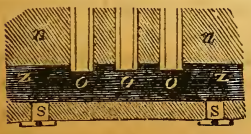
If a fire be made in the fuel chamber *n*, and the door of the ash pit properly closed, the air will rise from the ash pit to supply the fire, and the air in the suction flue will flow into the ash pit to replace it; and as the opening, *x*, of the suction flue is in the floor of the conservatory, by this means the air of the house will be drawn into the furnace, and after it has flowed through the fuel, will escape by the chimney, into the atmosphere.

As much air, however, must be admitted as is drawn off by the suction flue. This is done by the air pipes or caliducts; and these being heated, the air flowing through them is heated also, and they transmit a constant current of sweet, balmy, untainted air into the greenhouse, and which, as it becomes vitiated by the

vegetable organic action, is constantly withdrawn through the suction flue to supply the combustion of the fuel in the furnace.

It was suggested by Mr. Evelyn that a *porch*, furnished with a door, should be made at the entrance of the greenhouse, to prevent the house being cooled when persons went in or came out. In either case, the porch door being shut before the other was opened, no more warm air would be lost, nor more cold air be admitted by any one going in or coming out, than what was contained in the porch, so that the general temperature of the conservatory would be little affected. A porch might also be applied to a small wicket at the end of the house, so that the gardener would never be obliged to open any of the large doors. Sir D. Cullum, of Hawstead in Suffolk, a friend of Mr. Evelyn's, heated a conservatory in this way; he spoke in commendation of its operation, and made two improvements on his model. He formed a channel or flue along the end of the building, in which were several openings distant from each other, each closed with a door or register; and instead of the ends of the caliducts that came through the furnace opening to the conservatory, he inserted them into this channel. In Fig. XLIV., z z is the channel, *n* the wall of the greenhouse, *o o o* the ends of the caliducts, and *s s* two of the openings from the warm air channel into the greenhouse. The warm air, that flows through the caliducts into the channel, may be admitted through the apertures, s, s, at any part of the side, and thus be diffused more equally in the building.* The suction flue *x*, in Fig. XLI., was 18 inches wide, and the opening into it from the floor

FIG. XLIV.



* Kalendarium Hortense, p. 170.

was fitted with a plate having four holes, with a sliding lid upon each, by which he could admit more or less of the effete air at pleasure, and thus regulate the intensity of the fire as well as the ventilation. The earthen caliducts were placed about 16 inches above the firegrate.

Such is the brief outline, from the description of its author, of the most elegant, philosophical, and ingenious combined warming and ventilating apparatus that had yet been produced. It has been a model, like the Louvre grate, for many systems of heating; but if the greater neatness of modern workmanship be excepted, the variations made from Mr. Evelyn's examples have not always been improvements.

The opinions of Mr. Evelyn, that have been noticed in a previous essay, found a strenuous advocate in 'Tim Nourse.' He drew a glowing picture of the unrivalled situation of London, its salubrious air, magnificent buildings, spacious streets, beautiful environs, and the diffusion of wealth and comfort among its inhabitants; and he decided, much to his own satisfaction, that "London could stand nowhere but where it is," and that its advantages exceeded those of any other city whatsoever. But after many commendations, I shall, he says, add but one word more, which is, that of "all the cities in Europe, perhaps there is not a more nasty and more unpleasant place;"* and that the most intolerable of all its nuisances, and one which, if not redressed, will leave it exposed to many fatal inconveniences, is the sea-coal smoke which sullies its beauties; and all the innocent contents which the mind can take from fair prospects of buildings or country are lost in sooty clouds, which may be seen, felt, smelt, and tasted, at some miles distant. It is the use of sea-coal that creates

* Campania Felix, p. 349.

the great heaps or rather mountains of coal dust, that, like the sands of Arabia, invade and cover all places. These coal cinders choke up all the avenues to the city, so that foreigners would think London to be fortified with ramparts of ashes, or take these cinder mountains for the remains of the last dreadful conflagration. And which lying near the highways, on a fall of rain, make the roads so insufferably black and dirty, that if a man would ride a mile or two to take the air he must wade to his horse's belly in this rich balsamic compound, and be as much dappled and besmeared in coming from Highgate or Hackney as if he had rode post from York; and when the roads are dry, instead of drawing the sweet air into his lungs, he must suck in the sulphureous stinking powder, strong enough to provoke sneezing in one fallen into an apoplexy. The city itself, when there is no wind, especially in winter, is covered with a thick brovillard or cloud, which the sun has not force to scatter, to remedy which the citizens are forced to make more fires than ordinary, so that the more fire the more smoke, and the more smoke the more need there is of fire.

The only remedy for this, according to Mr. Nourse, is to burn wood or charcoal instead of pit coal; and he shows that a sufficient quantity of wood to supply the metropolis might easily be had from the counties adjoining it. He estimates the number of inhabitants to be between 400,000 and 500,000, and the number of houses in the precincts of London, Westminster, and Southwark, at forty thousand; and as few houses had less than five or six chimneys, and a great number had many more, he considers nine chimneys to a house to be a fair average, so that the 360,000 hearths will require about 400,000 cords or loads of wood, each load weighing a ton. But allowing brewers, dyers, and other "furnace gentlemen," to use sea

coal, 350,000 loads would be sufficient for the domestic supply of the capital. An acre of coppice wood, of twelve or thirteen years' growth, if moderately stored, will yield about 60 cords of firewood, each cord or load being 8 feet long, 5 feet 6 inches high, and as wide as the length of the billets, which is 3 feet, all closely laid together. An acre of good woodland will, however, yield five loads of wood more; so that sixty thousand acres of wood would be amply sufficient to supply London with fuel. That part of Sussex and Kent lying between Tunbridge Wells and Rye, about 30 miles long, is covered with trees; and a great part of Buckinghamshire, Oxfordshire, and Berkshire also abounds with timber. In addition to this source of supply, he proposes to plant twenty thousand acres of the waste lands that lie within 30 miles of London, all of which being stocked only with "rascally geese and sheep," are not worth five shillings an acre, but which in woods would be worth at least 20 shillings.

Something, says this projector, may be objected to wood, as being more cumbersome when stowed than coal; but even, although many houses in the city have no back area for such bulky fuel, they could use charcoal which will lie in as little space as coal. Another objection against the use of wood now in London, says Nourse, is the great quantity of fir in floors, partitions, and wainscot, and the hearths being made so small, and the wainscot fixed so near them; whereas coal fires lying in a grate are not apt to fall on the floors, or if they do the cinders die quickly. But these inconveniences he is certain would be more than compensated by the clearer air, and the supply of fuel not being liable to interruptions from enemies or storms, through both of which London has been afflicted with a want of firing in past times, and may be distressed again.

Twelve years before this time 300,000 chaldrons of coal were brought into London,* so that, perhaps, 320,000 chaldrons were consumed when Mr. Nourse was writing.

Sash windows, that were introduced about the time of the great fire, were very common. The upper valve was fixed, and the under one, when raised, was kept at various heights by means of a series of notches and a catch to hook into them. The next improvement, introduced with King William, is considered to be a Dutch invention. In this the under sash was suspended by a weight and line, and moved over a pulley. The wood-work of these sashes was very massive and clumsy, and, from the thickness and width of the astragal, a large window had much the appearance of a portcullis filled with glass, of a very indifferent quality.† The sill of the window

* McCulloch. Dict. of Commerce, p. 293.

† Many sorts of glass were in the market, called Lambeth or Ratcliffe, Normandy, German, white and green, Dutch, Newcastle, Staffordshire, and Bristol glass, looking glass and jealous glass. In 1691, the glass made at the Bear Garden on the Bankside was called "crown window glass, exceeding French glass in all its qualifications." The manufactory being removed to Ratcliffe, the glass was called "Ratcliffe crown glass." This was of a "light sky blue colour." The maker of this went over to France on purpose to learn the art, and then outdid his teachers. Lambeth crown glass was of a darker colour than the preceding, inclining something to a green. French glass came from Cherbourg, afterwards from Auxerre, in Burgundy. It was thinner and more transparent than Newcastle glass, and when laid on white paper had a dirtyish green colour. White German glass was free from the spots and blemishes that abounded in Newcastle glass, but it also had some fine or small curved streaks or lines, like those in Newcastle glass.

The green German glass had also fine lines or streaks, like those in the white sort, but neither the white nor green sort was so crooked and warped as Newcastle glass. The tables of Dutch glass were small, and were not much used in England; Newcastle glass was of an ash colour, much subject to specks and blemishes and streaks, and very often warped and crooked. It was, however, most in use. Staffordshire glass was seldom used in London; Bristol glass also was rarely used, from the want of a cheap, convenient sea carriage, as the Newcastle manufacturers had, though it was reckoned better than Newcastle glass. Looking glass plates were sometimes used in windows. *Jealous glass* cast in a mould was composed over its surface with a multitude of oblong concave circular figures. It was commonly used to put into the lower lights of sash windows, when they were low against the street, to prevent people seeing into the room as they

frame was most imperfect. Shutters were common, and corresponded in clumsiness with the sashes. They had not yet, however, become necessaries in bed-rooms, except in the best chambers of great houses. Rebated doors were also another contribution to comfort at the Revolution; and carpenters now began to tongue and groove the flooring boards, which prevented persons in the chamber overhead seeing what was going on in the room under, where the ceilings were not plastered. Tongueing and grooving boarded partitions was another clever innovation which shut up a multitude of holes, that made as many crevice winds as there were deals used. When I compare, says Neve, the modern way of building with the old way, I cannot but wonder at the genius of old times. Nothing is, or can be, more delightful and convenient than height, and nothing more agreeable to health than free air; and yet one would think the people of former ages were afraid of good air and light, "whereas the genius of our times is altogether for light staircases, fine sash windows, and lofty ceilings. And such has been of late our builders' industry, in point of compactness and uniformity, that a house after the new way will afford on the same quantity of ground many more conveniences. The contrivance of closets in most rooms, and painted wainscot, now so much used, are also two great improvements, the one for convenience, the other for cleanliness and health; and indeed for so damp a country as England nothing could be better contrived than wainscot to keep off the ill impression of damp walls. In short, for handsome accommodation and neatness of lodging, London has undoubtedly got the pre-eminence.

passed by; and was sometimes set in lead in places where they would not have their actions overlooked. Woolwich, or Woolledge glass was another sort, from a glass-house there, that was given up from want of encouragement.

The greatest objection to its buildings, mostly of brick, is their slightness, occasioned by the fines exacted by the landlords, so that few of the common houses are built to last longer than the ground lease, which runs from fifty to sixty years. In the meantime, however, if there happens to be a fit of excessive heat or cold, the tenant must needs be uneasy at it. The plastered ceilings also, so much used in England beyond other countries, make, by their whiteness, the rooms much lightsomer, and are excellent against raging fires; they stop the passage of the dust, lessen the noise overhead, and in summer time the air of a room is something the cooler for them, and in the winter something the warmer, because it keeps out cold air better than boarded floors can do."*

All these improvements in the construction and finishing of rooms were superseding an article of furniture that had been used in England from the earliest times to the present. To protect themselves as well as they could from the effects of currents of air, our ancestors had wooden screens or other fences impervious to the air behind their seats. In handsome apartments, these screens were ornamented in a variety of ways, and made, as may now be seen in old mansions, with several leaves; they were sometimes as high as the door, and always a little higher than the mantel of the fireplace, and very lightly framed; some of them could be extended upwards of twenty feet. In farm houses and kitchens, the seat and the fence were united, and formed one piece of substantial furniture that was occasionally made very ornamental. Round a large fire, by means of the high backed form, they were kept warm by the radiant heat falling on their persons, while the air they breathed was little heated; and according to

* Country and City Purchaser. Art. Building.

Williams, an admirer of the time gone by, their lungs did not receive such a sudden shock when they moved from their seat, as ours do when we leave our close carpeted rooms. It is clear, he thinks, that our ancestors were not so subject to diseases arising from debility as we are; they almost may be said to have lived in the open air, for in the houses of all classes the apertures of the chimneys were large, the windows and doors badly fitted; and when a fire was kindled in the apartment, the change of air must have been so very rapid, that a thermometer placed in such a room could have stood but a few degrees higher than one fixed out of doors.*

The shops were all open, like those of the modern fishmongers and butchers; and warmth in the parlours opening into these roofed areas must have been out of the question.

The excellent arrangement introduced by Jones, Wren, and others into houses, greatly improved every thing connected with comfort and convenience. Rushes on the floors in towns had nearly disappeared, except in churches; and mats and carpets, according to a modern phrase, were looking downwards into the best room of the aspiring tradesman. Cushioned chairs and stools, curtains to windows, were common, and the use of mirrors for ornament in rooms was beginning to give them a lighter appearance. The fireplaces were, however, still wide and high, and the flues preposterously large. Wood and charcoal continued to be considered so much the preferable fuel, that a charcoal fire prepared for their gratification, was still a mark of respect shown to his company by a coal burner. Sea-coals were, however, employed in the palace of William and Mary, except in a few apartments. The bedchambers of the king

* On Climate, p. 174.

and queen, and some rooms in the care of the pages, the withdrawing room and privy chamber, and the apartments of the maids of honour and council chamber, were supplied with billets and charcoal; in the other rooms sea-coals were burned. Thirty-six pounds a year were paid for "making pit coal fiers in the presence and guard chambers on both sides;"* and in the same establishment, fifty pounds a year were paid to the gentlemen of the ewry for "sweets for their majesties' linen," and orange flower water for their royal hands; and a yeoman of the ice-house is allowed ninety-one pounds for filling the pits with ice,—which must have been so rare a luxury in England, that very few could know how to use it—and none, perhaps, thought of applying it to cool the air of an apartment.

Coals were now the staple fuel, but the dealers in the fossil, at the accession of King William, had not lost their original and ancient name of woodmongers; they then lived on the wharfs, kept horses and carts of their own, bought their coals at Billingsgate of the masters of the ships, and were there plied by the lightermen for the carriage of their coals from the ship's side to the wharf, as watermen now ply for passengers at the landing places and stairs; larger ships, however, coming daily to be employed in the trade, whose cargoes were too large for any one or two woodmongers to purchase and dispose of, the lightermen took the hint to do what the woodmongers could not; by which means, from carriers they at once became traders of a superior class, and found themselves in a position to treat those who had been their masters, as their customers —perhaps like their dependents and understrappers. Nor did these invaders stop here, for having taken

* Illustrations of Manners, p. 493.

possession of the hive, they hit on the following scheme to keep all the sweets to themselves.

When a fleet of colliers was expected, fifteen of the most considerable of these upstart engrossers used to hold a cabal, in which having first settled the market price of the coal to their own satisfaction, each staked a moidore by way of gage that he would not make a breach in the standard agreed on. If any ships outsailed the rest, and the master took advantage of his good luck to ask a shilling or two more in the chalder than the cabal had thought proper to allow, no sooner did the rest of the ships come in, than the purchaser obliged the master to forego his advantage, or else baulked the ship, and no body would or durst buy the remainder. By these, and such means, they who some years before begged for a lading of coals, were enabled to keep their coaches, and found themselves masters of the whole trade, which they carried on under the more pompous title of *Coal Merchant*.*

But, as those who have power are apt to abuse it, the mischiefs arising from the ship-masters on the one hand, and the arbitrary conduct of these men on the other, at last affected the interests of dealers and the consumer so much, that an act was passed to open the trade; a reformation that did not last long. The lower class of lightermen having neither craft nor customers to take off a cargo of 300 or 400 tons, the trade was still kept in the hands of the overgrown gentlemen, who, dealing for the whole freight, would sell only on their own terms, so that the purchaser was as much at their mercy as before.

Breaking up this combination, however, grievously affected the established dealers; many persons not brought up in the regular way to the trade, and thence

* The Frauds and Abuses of the Coal Dealers, p. 9.

called *foreigners*, engaged in it, and carried it on through the "indiscretion of some who had wharfs and carts, and who became the hackneys of any who would employ them. Coal merchants now multiplied apace. If a footman had been preferred to be a runner to collect debts, he commenced beau, put on fine clothes, and set himself up as a coal merchant; and a pawnbroker, with his overflowing cash, would gild over his own dirty business with the same more reputable title; persons of all businesses and of no business, took sanctuary in this. Felony is so coarse a sin, and incurs so heavy a punishment, that even bad men start with horror at the very name of it; but many who are thus scrupulous as to thefts, scarce boggle at frauds, though the last is apparently a crime of the deeper dye, as adding a breach of trust to an invasion of property. And it has ever been, continues the pamphleteer, the reproach as well as misfortune of this trade, that persons have been found in every branch of it, who have acted as if their calling was but a license to cheat with impunity."*

* Ibid. p. 6.

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